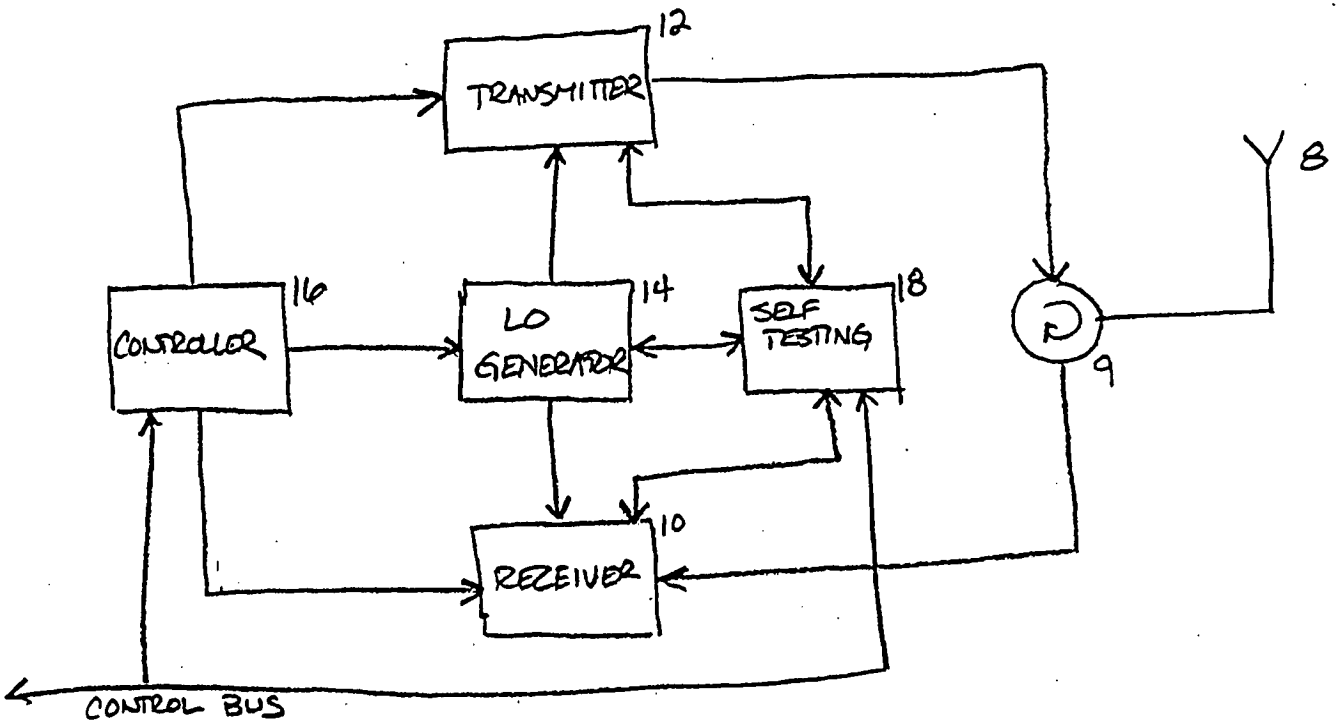

12
TRANSMITTER
8
16
CONTROLLER
14
LO GENERATOR
18
SELF TESTING
9
10
RECEIVER
CONTROL BUS

FIG. 1

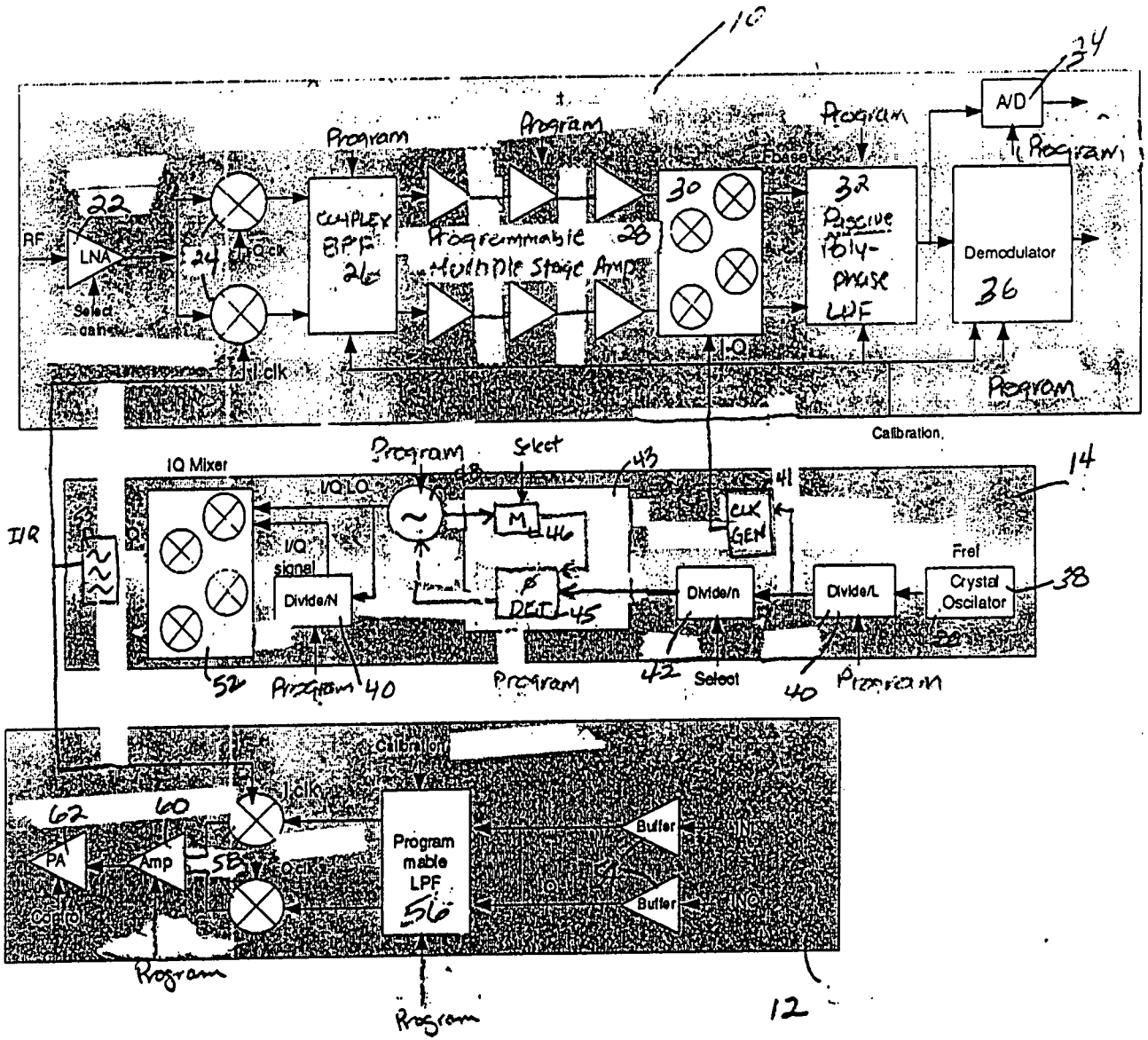

10
24
A/D
Program
Program
Program
Program
Fbase
22
RF
LNA
Select
gain
24
I clk
Q clk
COMPLEX BPF
26
Programmable Multiple Stage Amps
28
30
I
Q
32
Passive Poly-phase LPF
Demodulator
36
Program
Calibration
IQ Mixer
Program
Select
43
41
14
IIR
I/Q LO
M
46
CLK GEN
Fref
I/Q signal
Divide/N
P DET
45
Divide/n
Divide/L
Crystal Oscilator
38
52
Program
40
Program
42
Select
40
Program
Calibration
I clk
62
60
PA
Amp
58
Q clk
Control
Program mable LPF
56
Buffer
IN
I
Q
Buffer
INC
Program
Program
12

FIG. 2

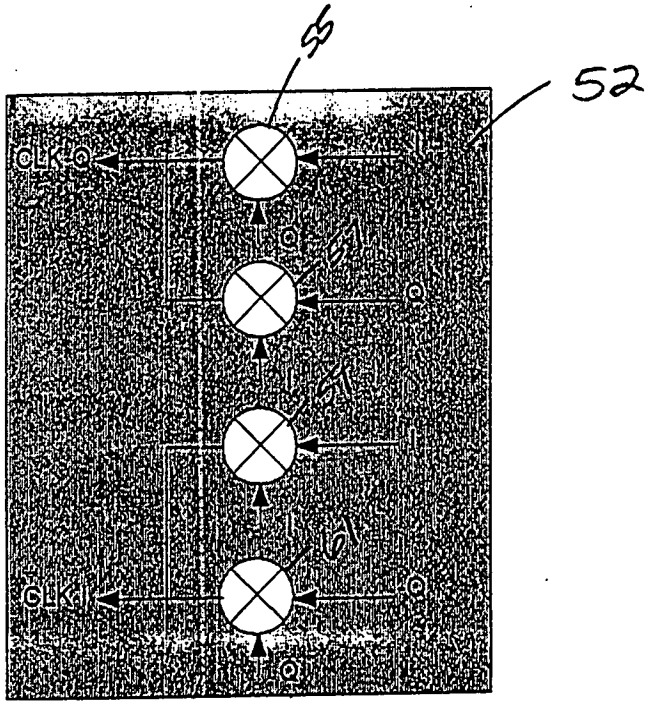


FIG. 3

0605604.00004

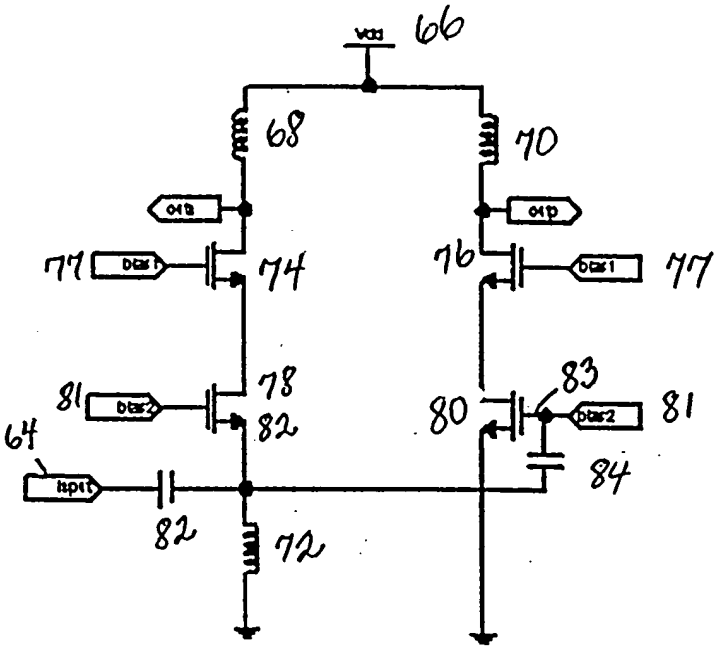


FIG. 4

0960650 .4002700.

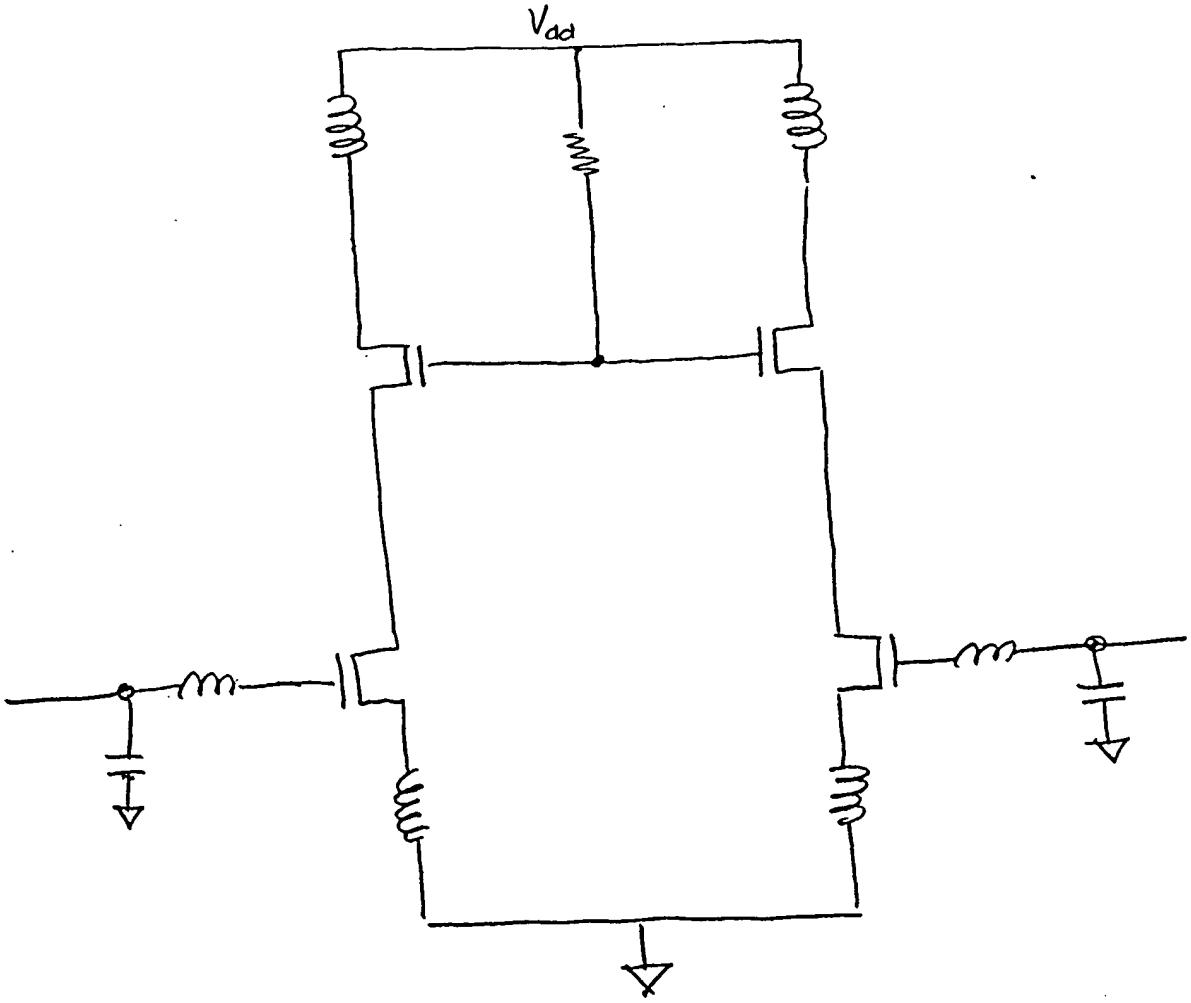


FIG. 4 (a)

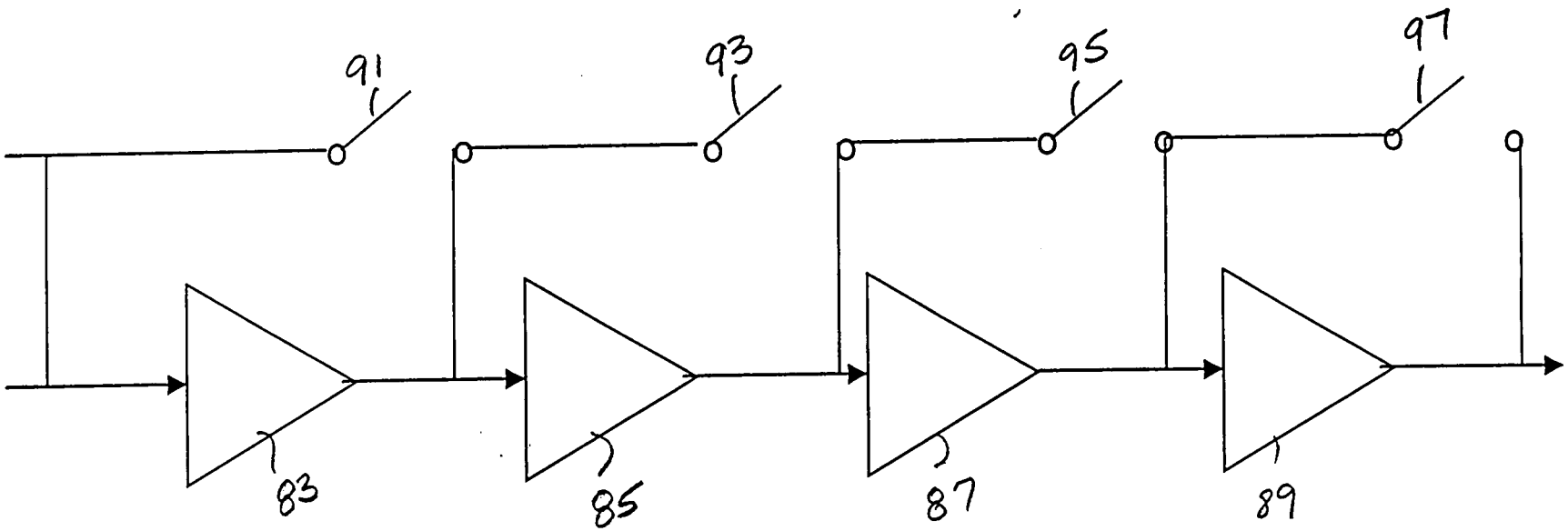


FIG. 5

0050450 - 2007-06-20

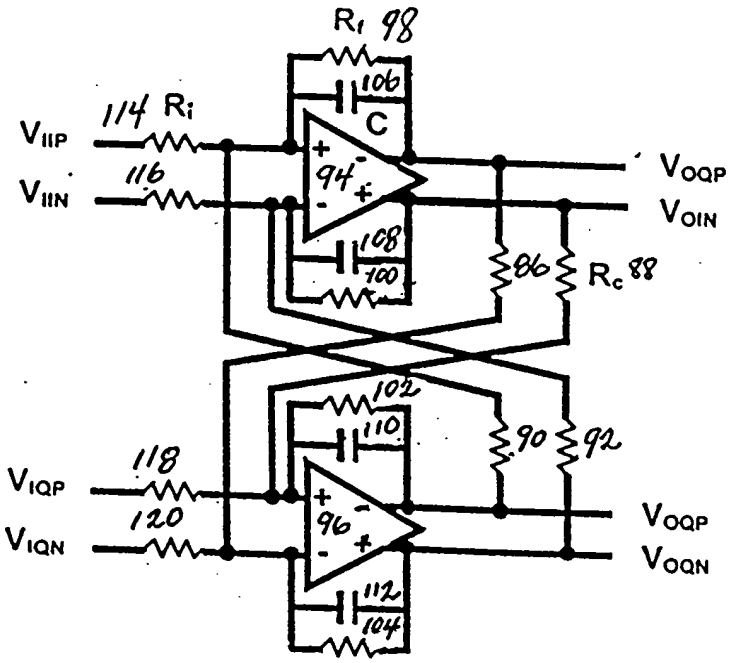


FIG. 6

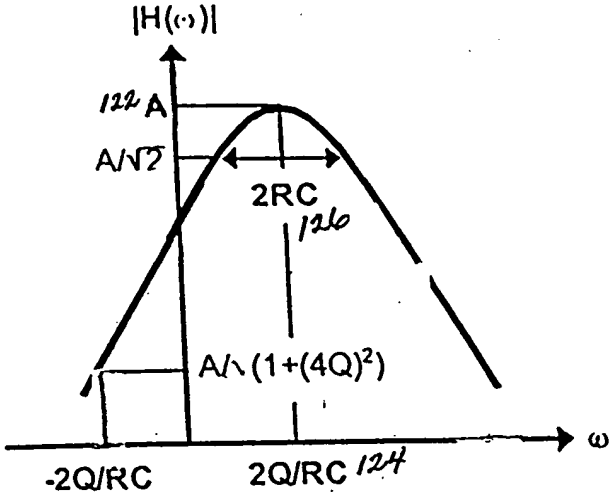


FIG. 7

0606450 - 4022000

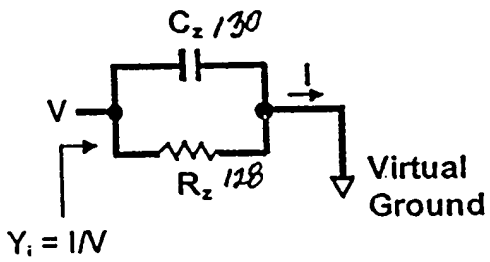


FIG. 8

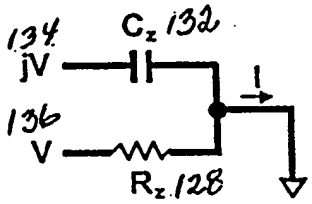


FIG. 9

Doc Code: I.D.S.

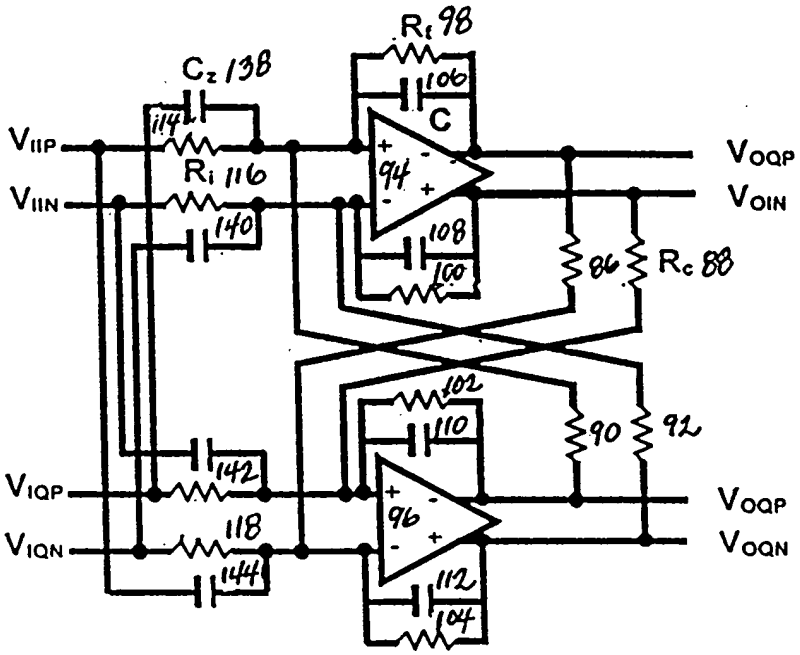


FIG. 10

0095207 "2540950

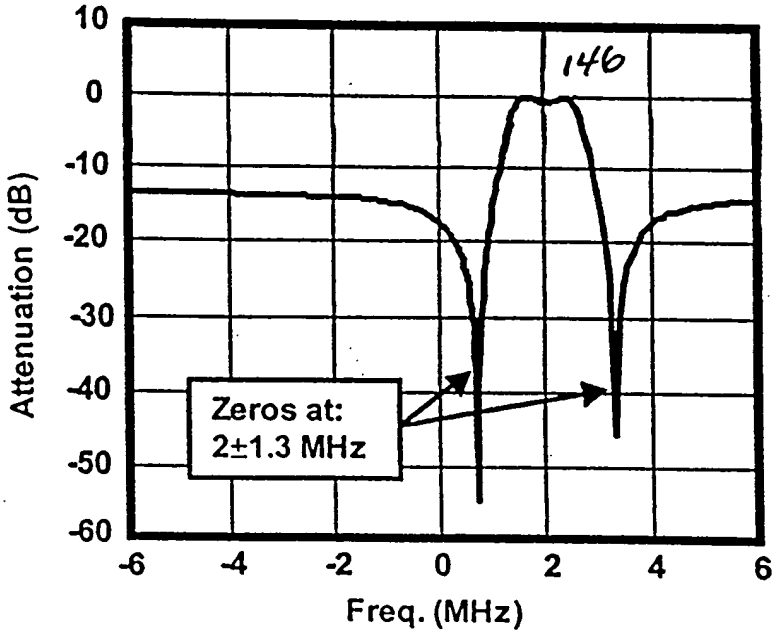


FIG. 11

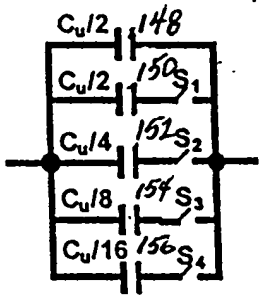


FIG. 12(a)

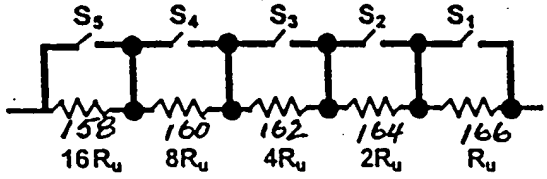


FIG. 12(b)

0050050570 - 20050308

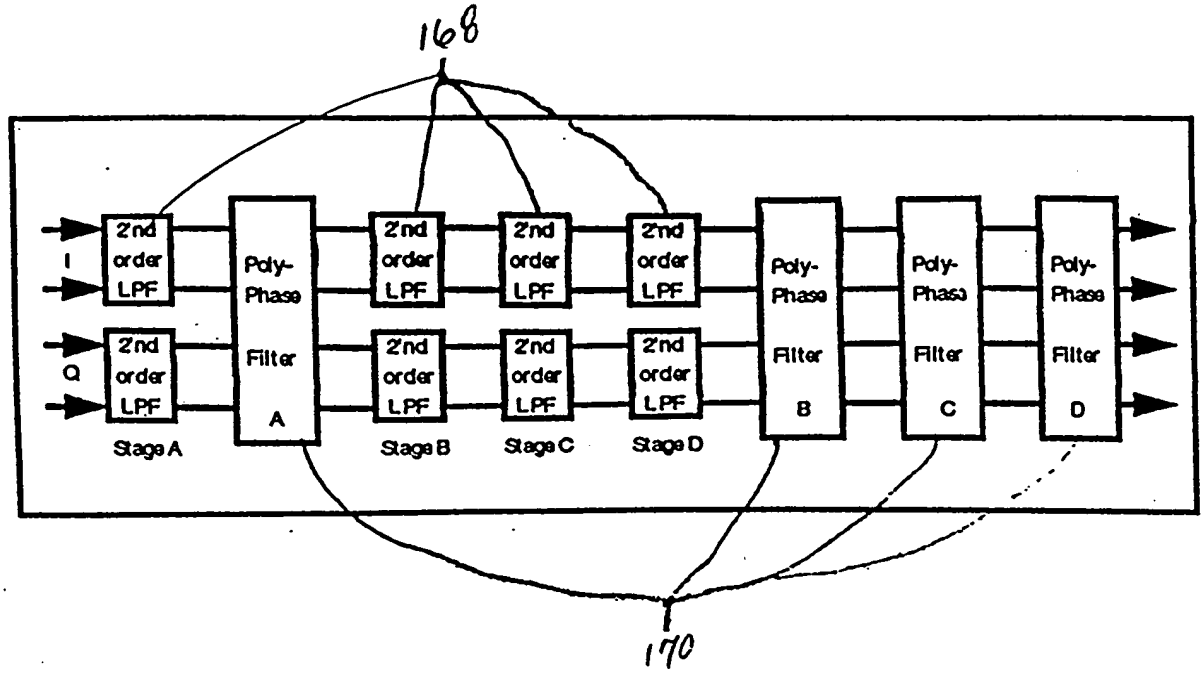

168
I
Q
2nd order LPF
Poly-Phase Filter A
Poly-Phase Filter B
Poly-Phase Filter C
Poly-Phase Filter D
Stage A
Stage B
Stage C
Stage D
170

FIG. 13

.00720T "26h86960

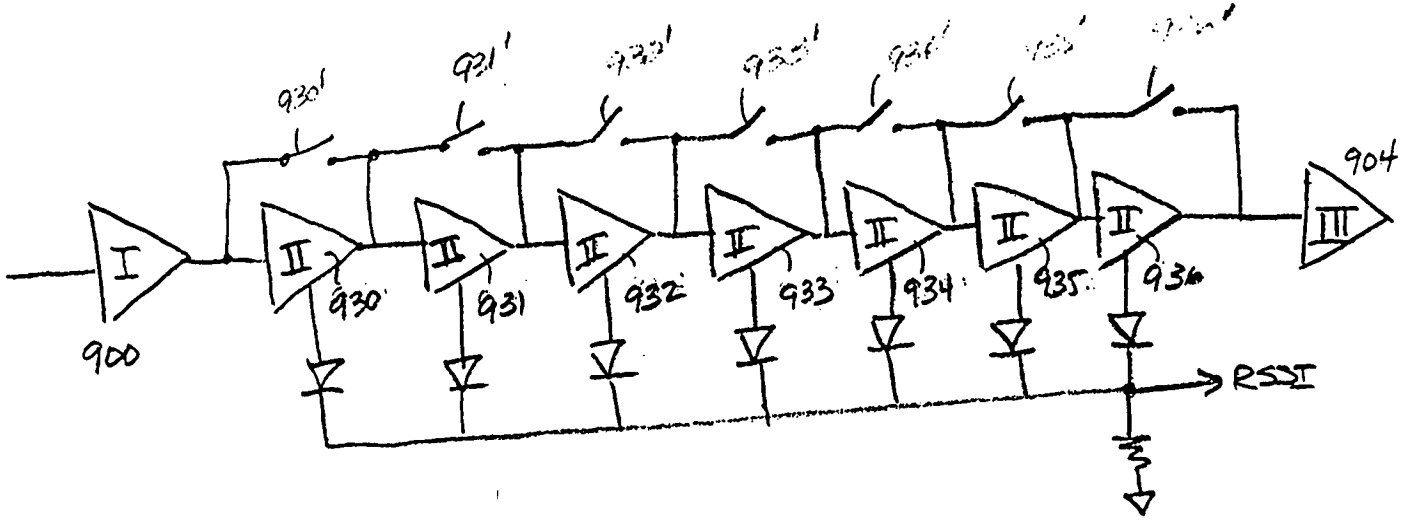


FIG. 14

Document: 1005

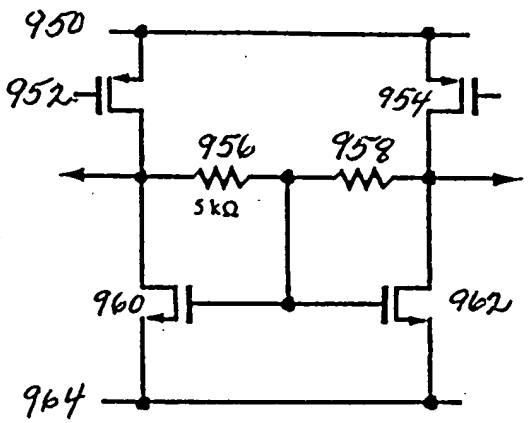


FIG. 15

DO NOT ENTER

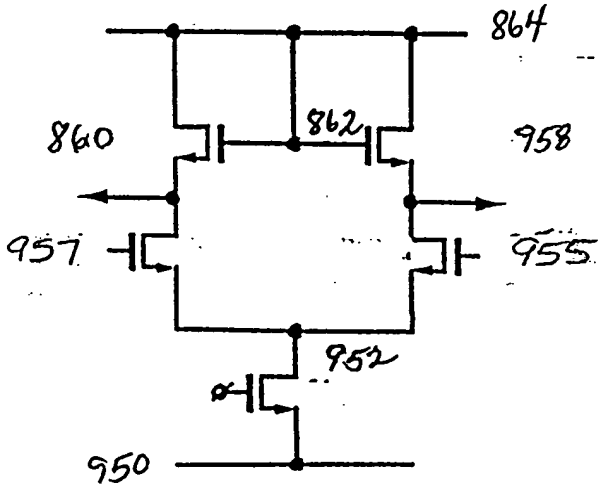


FIG. 16(a)

Document - 6,496,690

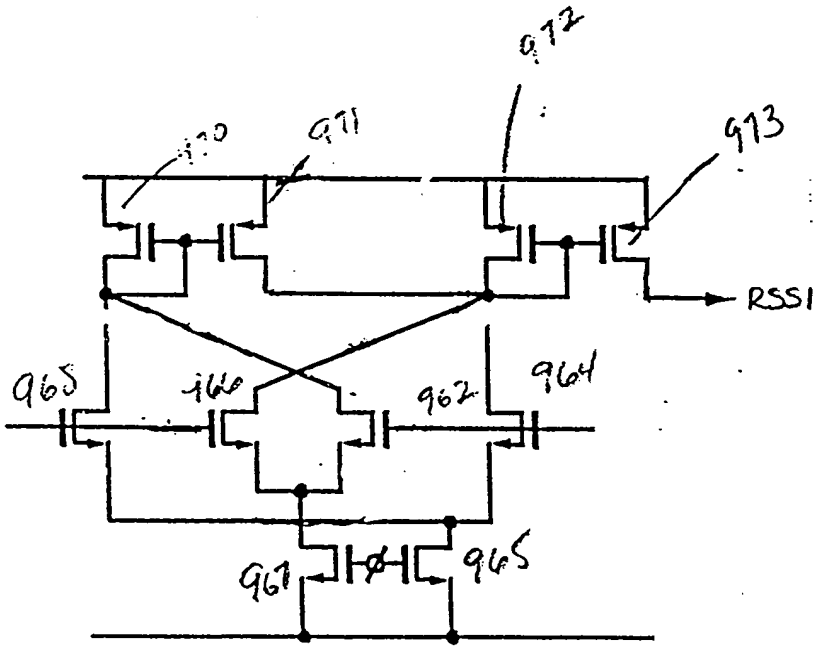


FIG. 16(b)

FIG. 17(a)

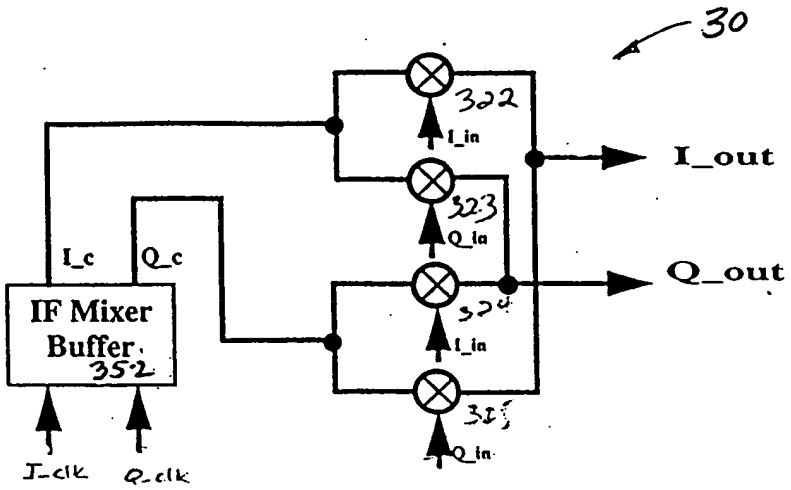
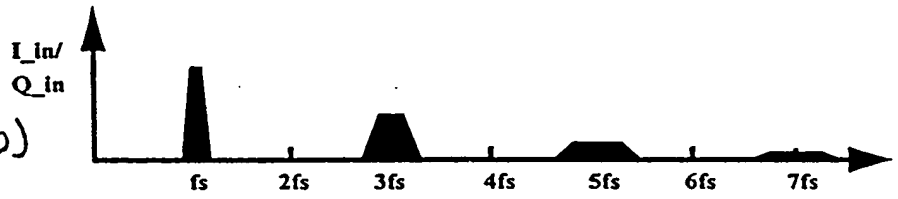
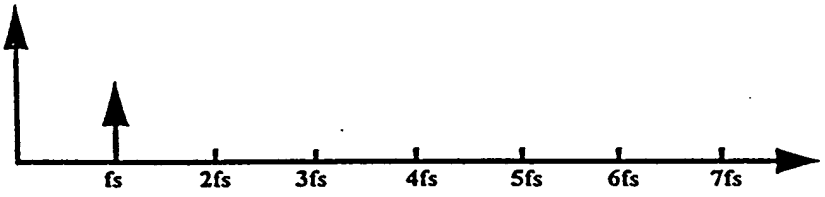


FIG. 17(b)



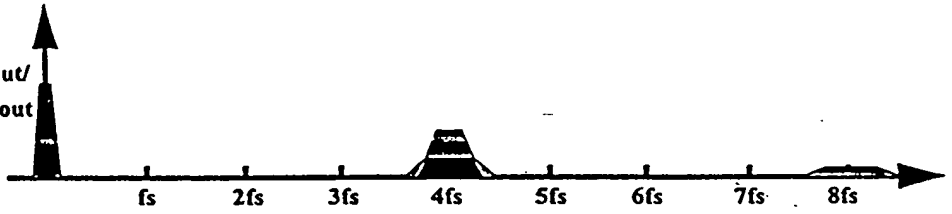
Limited IF Signal Spectrum

FIG. 17(c)



Sinusoidal Input Spectrum

FIG. 17(d)



IF MixerOutput Spectrum

09604769 - 100200

FIG. 18

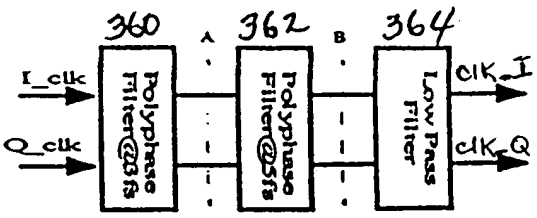
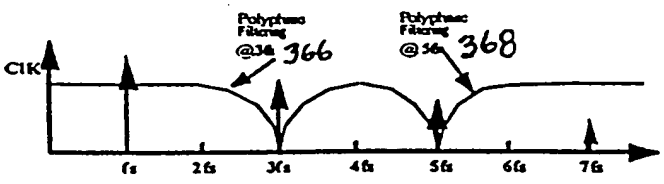
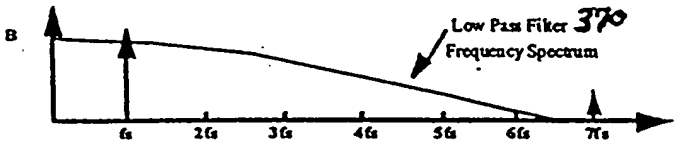


FIG. 19(a)



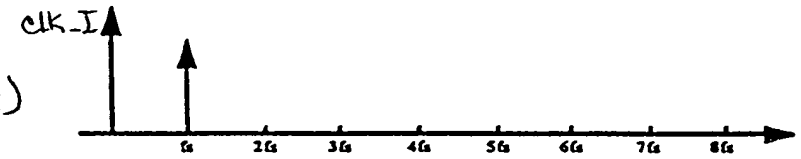
Differential Input Clock Signal Spectrum

FIG. 19(b)



Signal Spectrum After 3fs and 5fs Polyphase

FIG. 19(c)



Sinusoidal Signal Generation After Low Pass Filter

0-09-2003 : 10:54:50 : 0

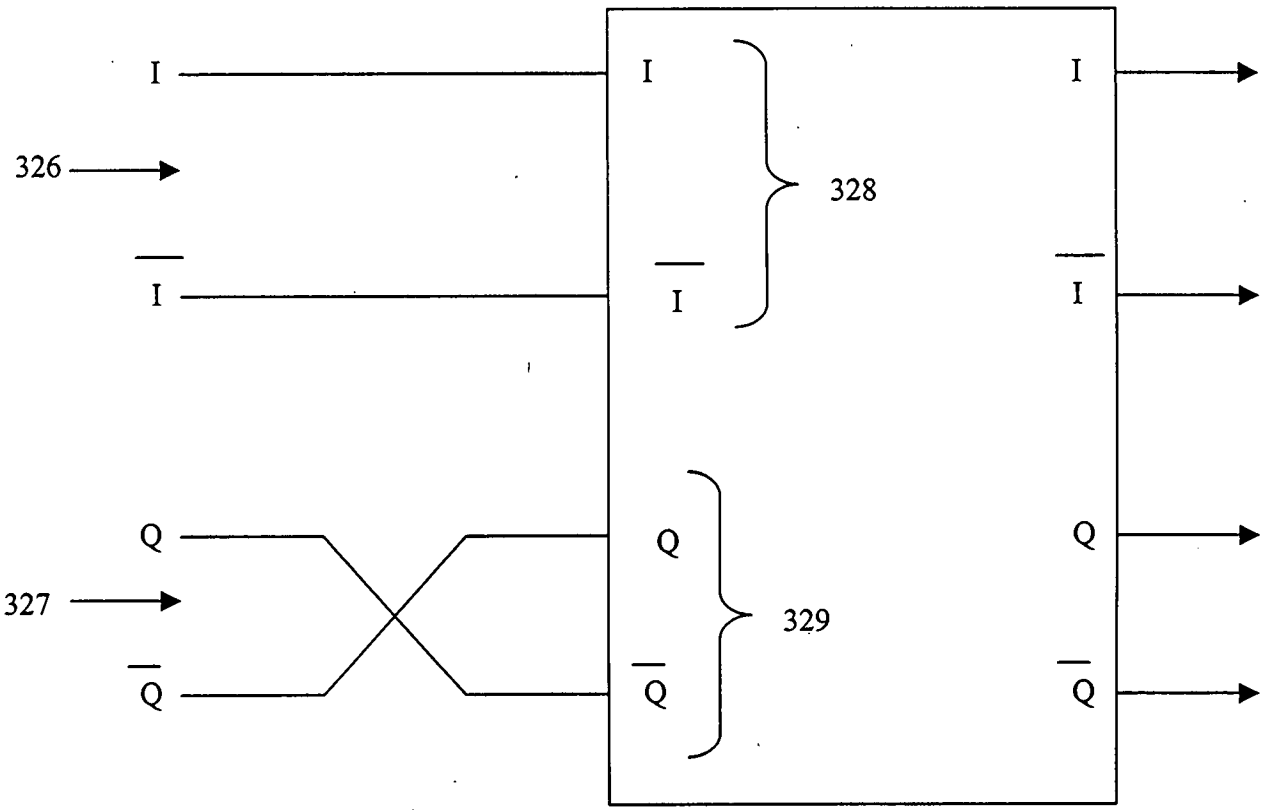

I
326
$\overline{I}$
Q
327
$\overline{Q}$
I
$\overline{I}$
328
Q
$\overline{Q}$
329
I
$\overline{I}$
Q
$\overline{Q}$

FIG. 19d

,00220T" 26h86960

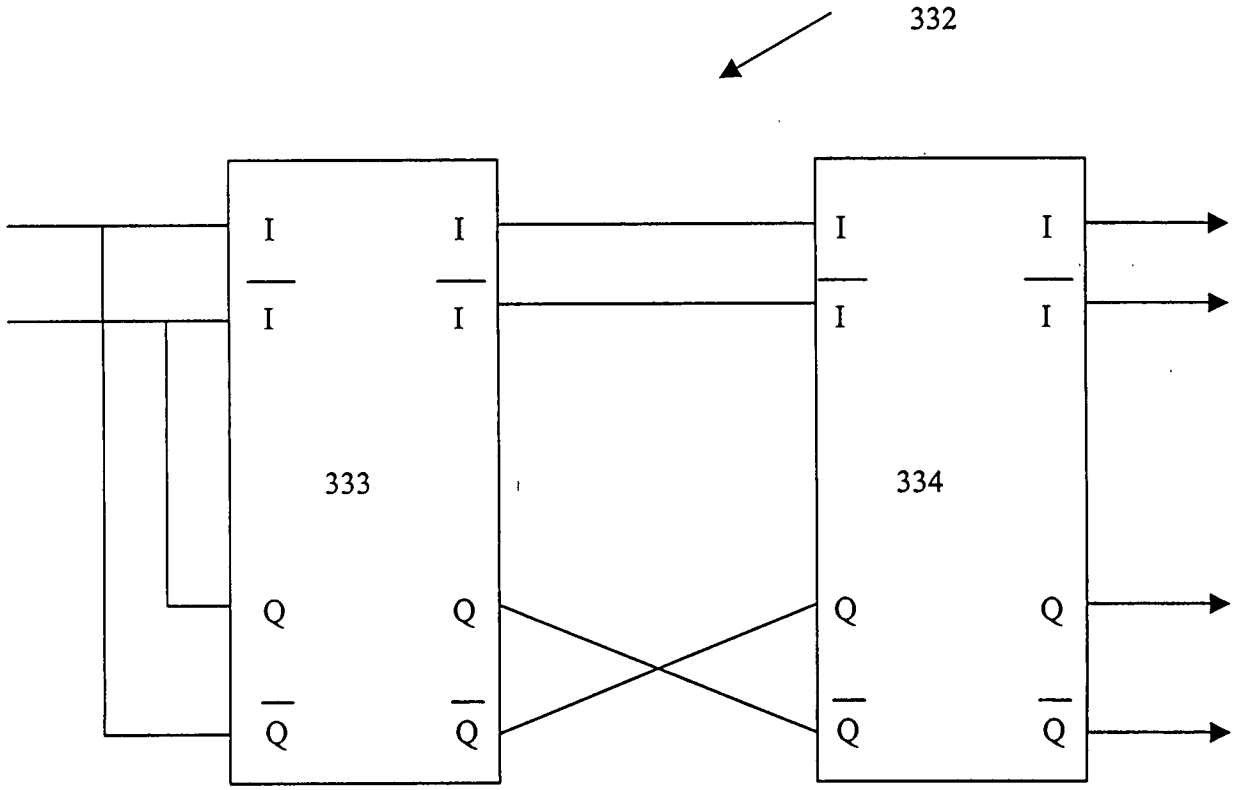


FIG. 19e

,00720T" 26n86960

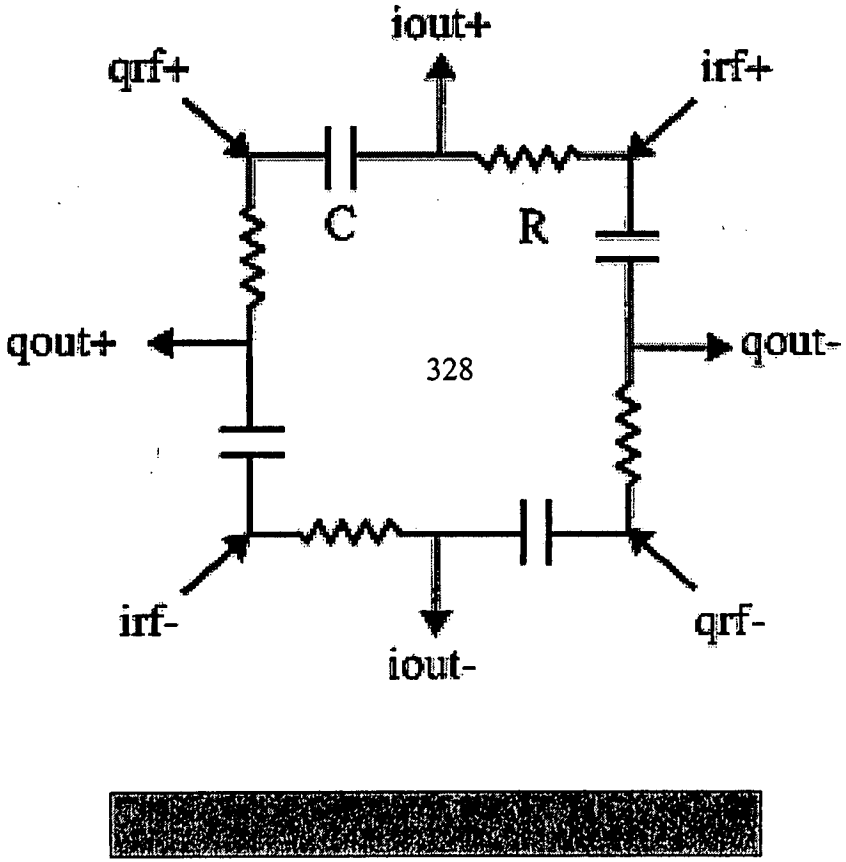
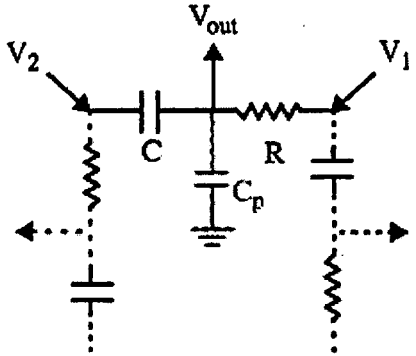


FIG. 19f

,00720T" 26h86960

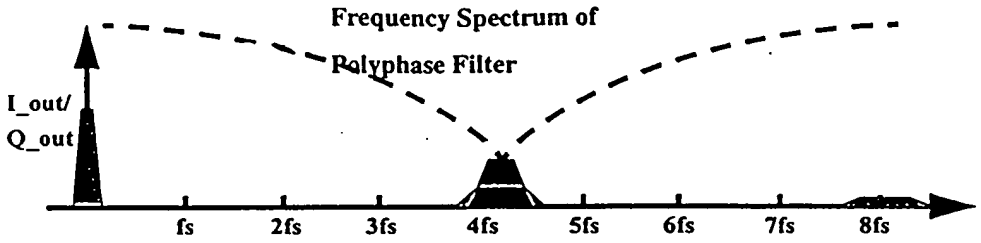


$$\omega_p = \frac{1}{R(C_p + C)}$$

$$\omega_o = \frac{1}{RC}$$

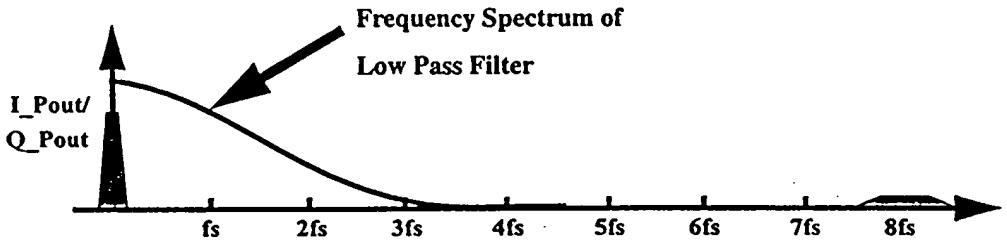
$$V_{out} = \frac{V_1}{R(C_p + C)s + 1} + \frac{V_2 RCs}{R(C_p + C)s + 1}$$

FIG. 19g



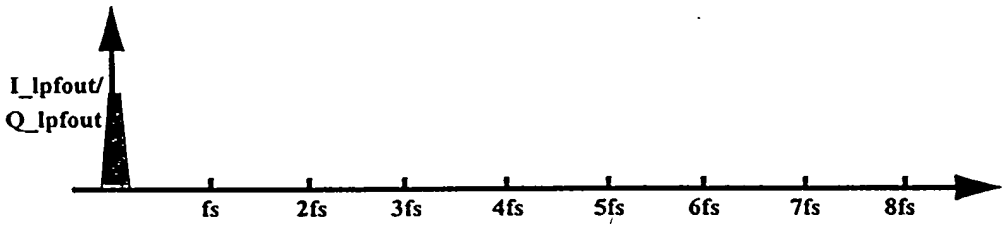
Signal Spectrum at Polyphase Input

FIG. 20(a)



Signal Spectrum at Polyphase Output

FIG. 20(b)



Signal Spectrum at Low Pass Filter Output

FIG. 20(c)

.0D\20HP\26850.0

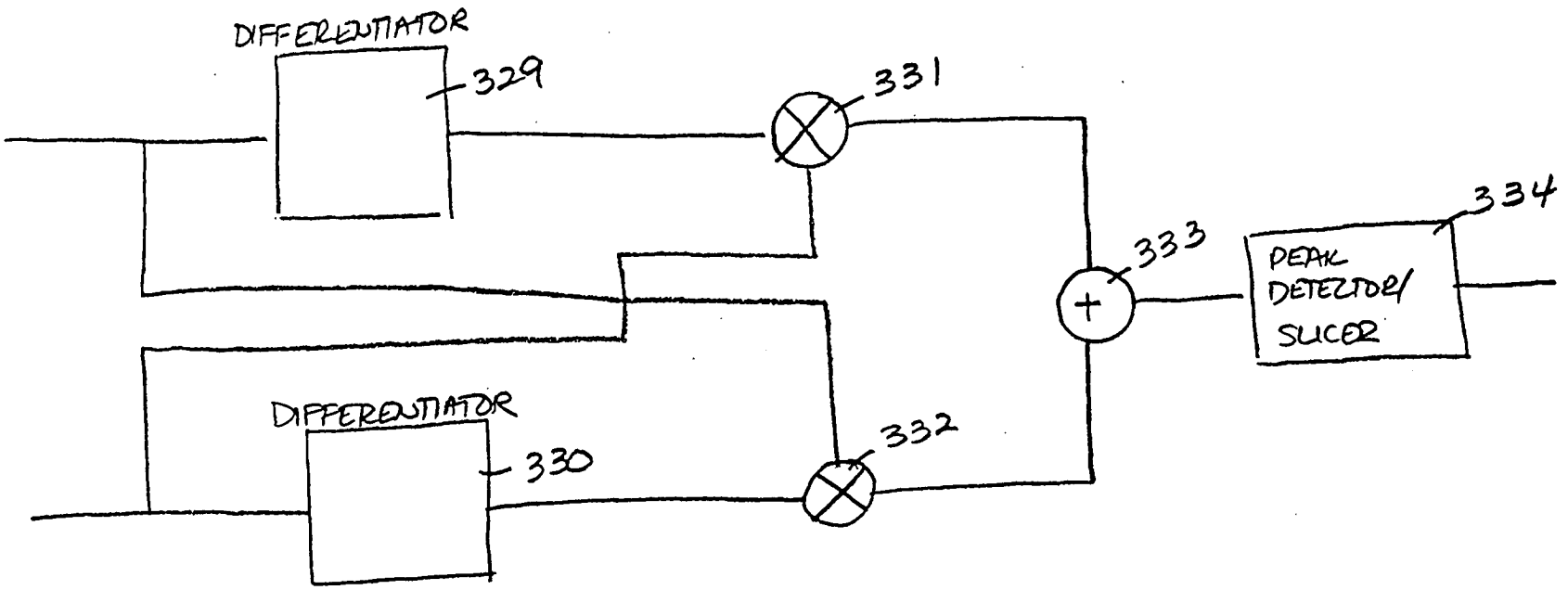

DIFFERENTIATOR
329
331
334
333
PEAK DETECTOR/ SLICER
DIFFERENTIATOR
330
332

FIG. 21

DO NOT ENTER

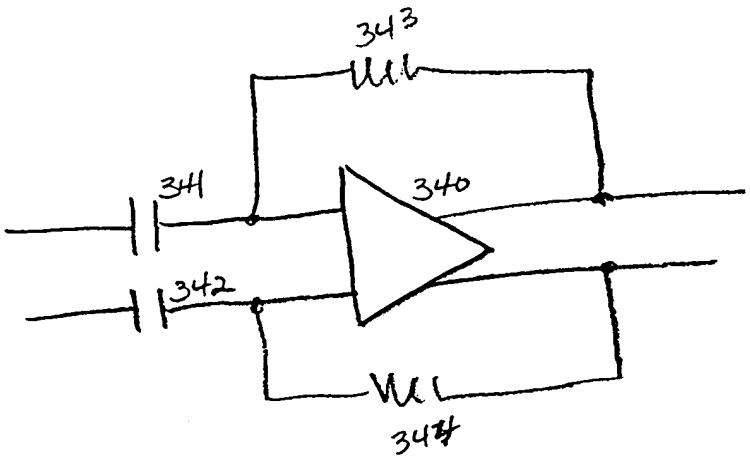


FIGURE 22

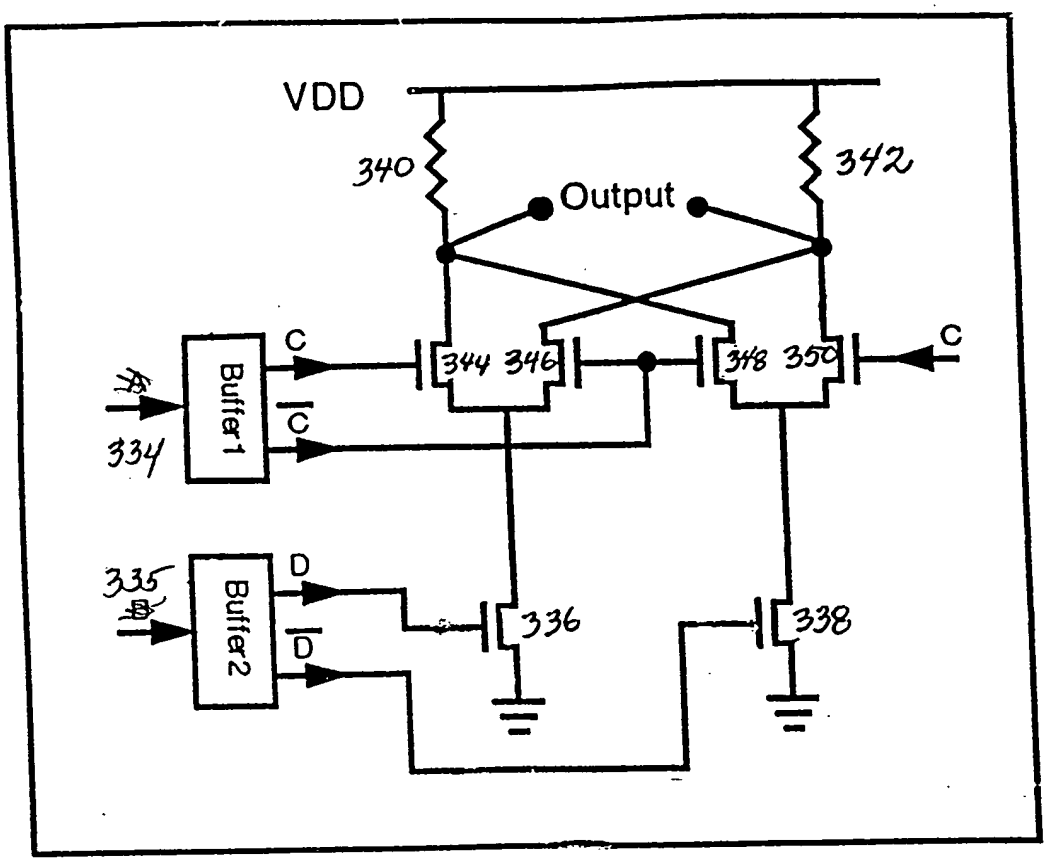

VDD
340
342
Output
C
344
346
348
350
C
A
334
Buffer1
C
335
B
Buffer2
D
D
336
338

FIG. 23

00/20015 PCT/US99/15960

FIGURE 34

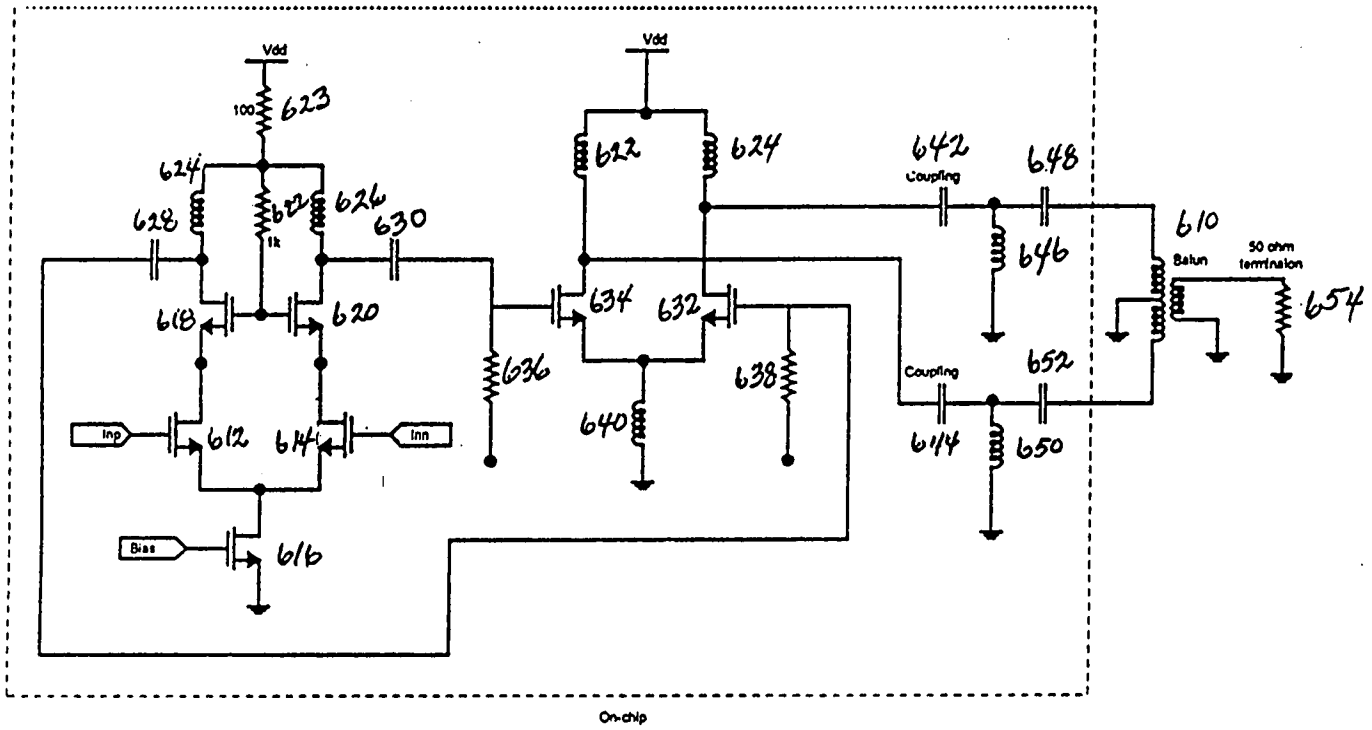

Vdd
100
623
624
628
626
630
1k
618
620
Inp
612
614
Inn
Bias
616
636
Vdd
622
624
634
632
638
640
642
Coupling
648
646
610
Balun
50 ohm termination
654
Coupling
652
614
650
On-chip

FIG. 25

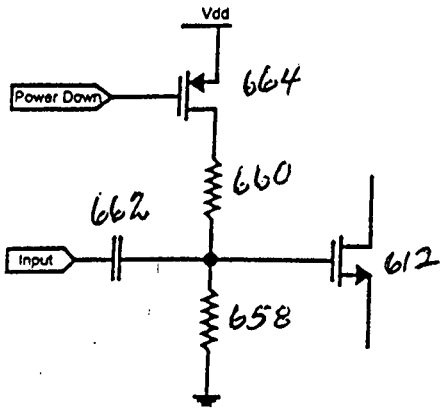


FIG. 26(a)

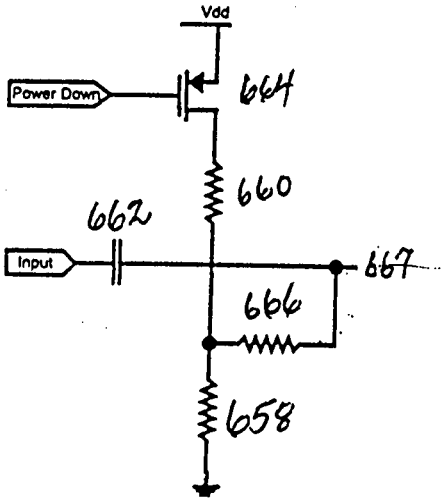


FIG. 26(b)

DOCKET NO. 60,409-0060

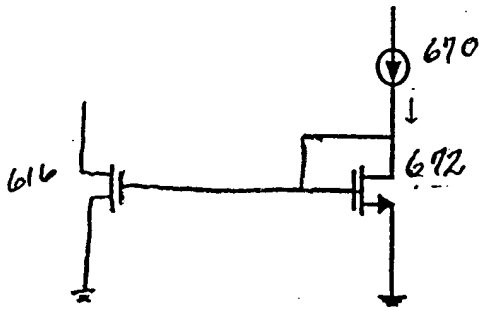


FIG. 27

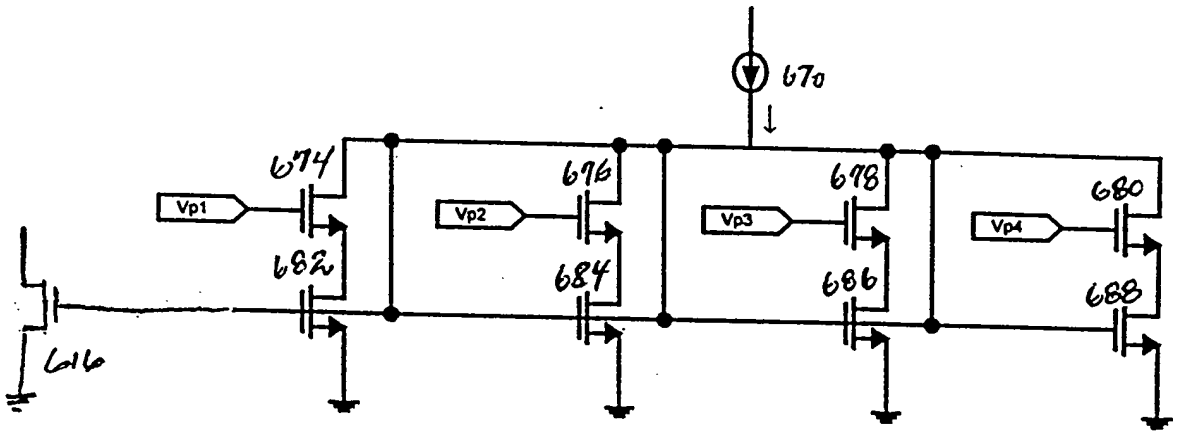


FIG. 28

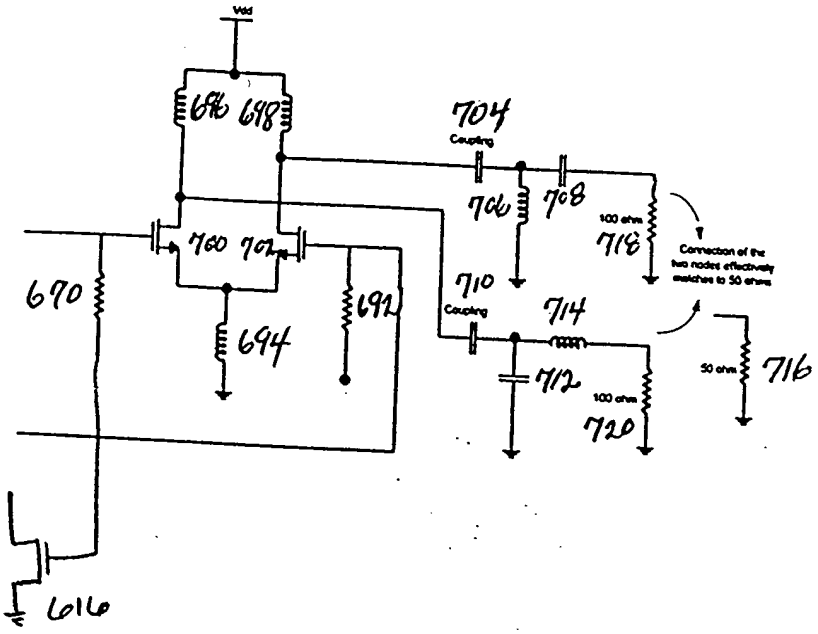

Vdd
696
698
704
Coupling
706
708
100 ohms
718
Connection of the two nodes effectively switches to 50 ohms
700
702
690
694
692
710
Coupling
714
712
100 ohms
720
50 ohms
716
6116

FIG. 29

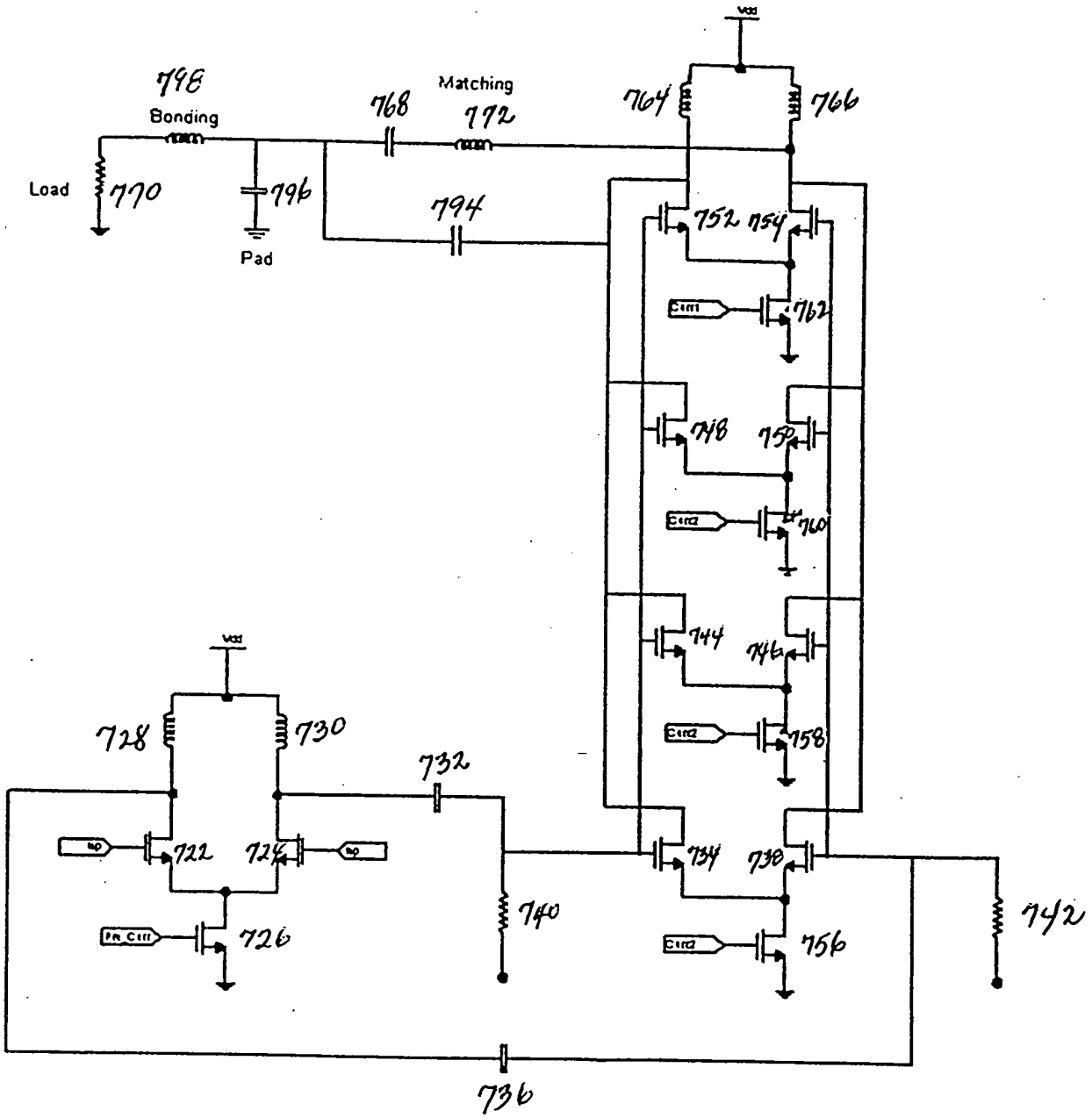

798
Bonding
768
Matching
772
764
766
Load
770
796
Pad
794
752
754
762
748
750
760
744
746
758
728
730
732
722
724
726
734
736
740
742
Ctrl1
Ctrl2
Pre_Ctrl

FIG. 30A

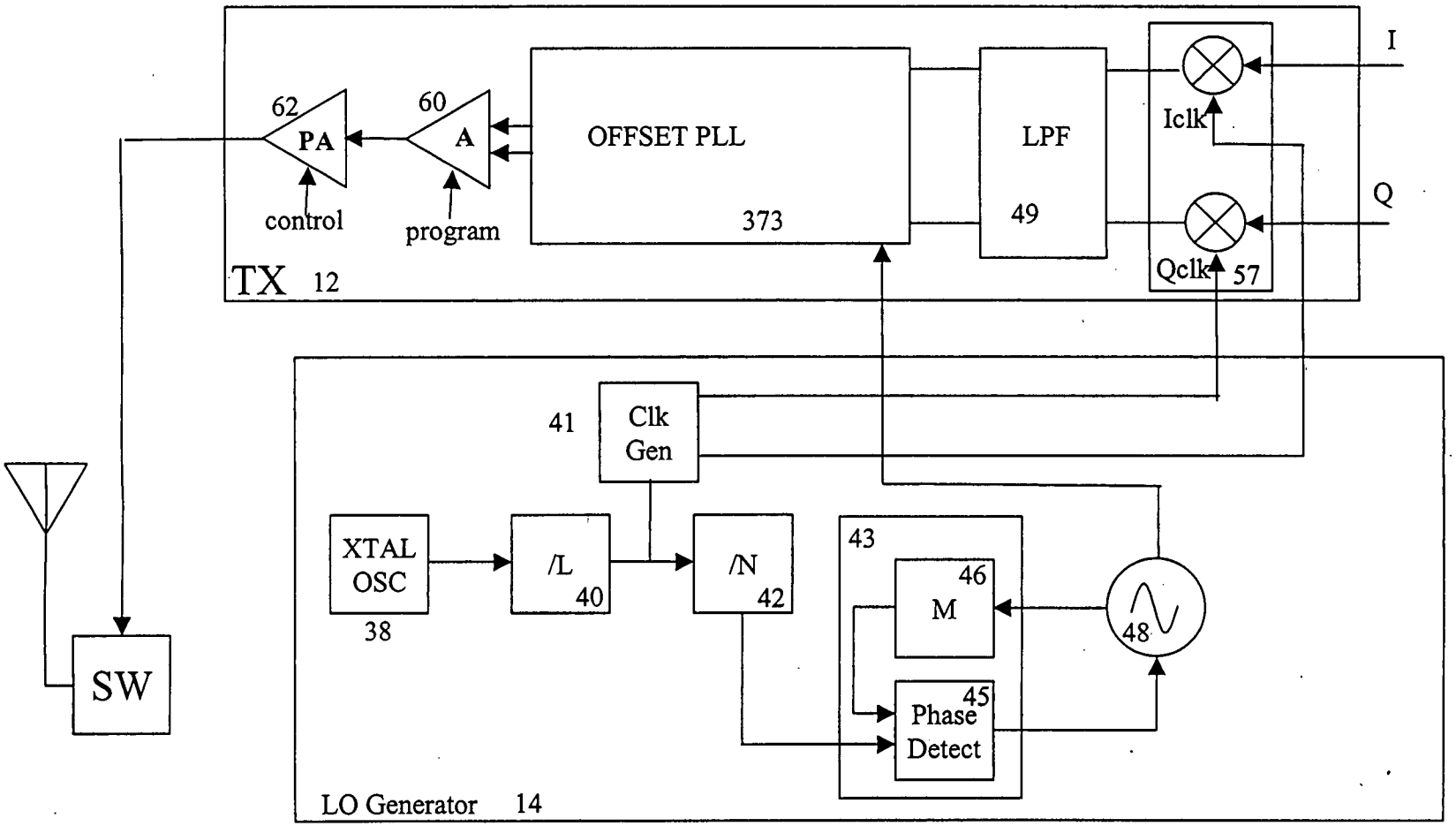

62
PA
60
A
control
program
OFFSET PLL
373
LPF
49
I
Iclk
Q
Qclk
57
TX 12
41
Clk
Gen
XTAL
OSC
38
/L
40
/N
42
43
46
M
48
45
Phase
Detect
LO Generator 14
SW

FIG. 30b

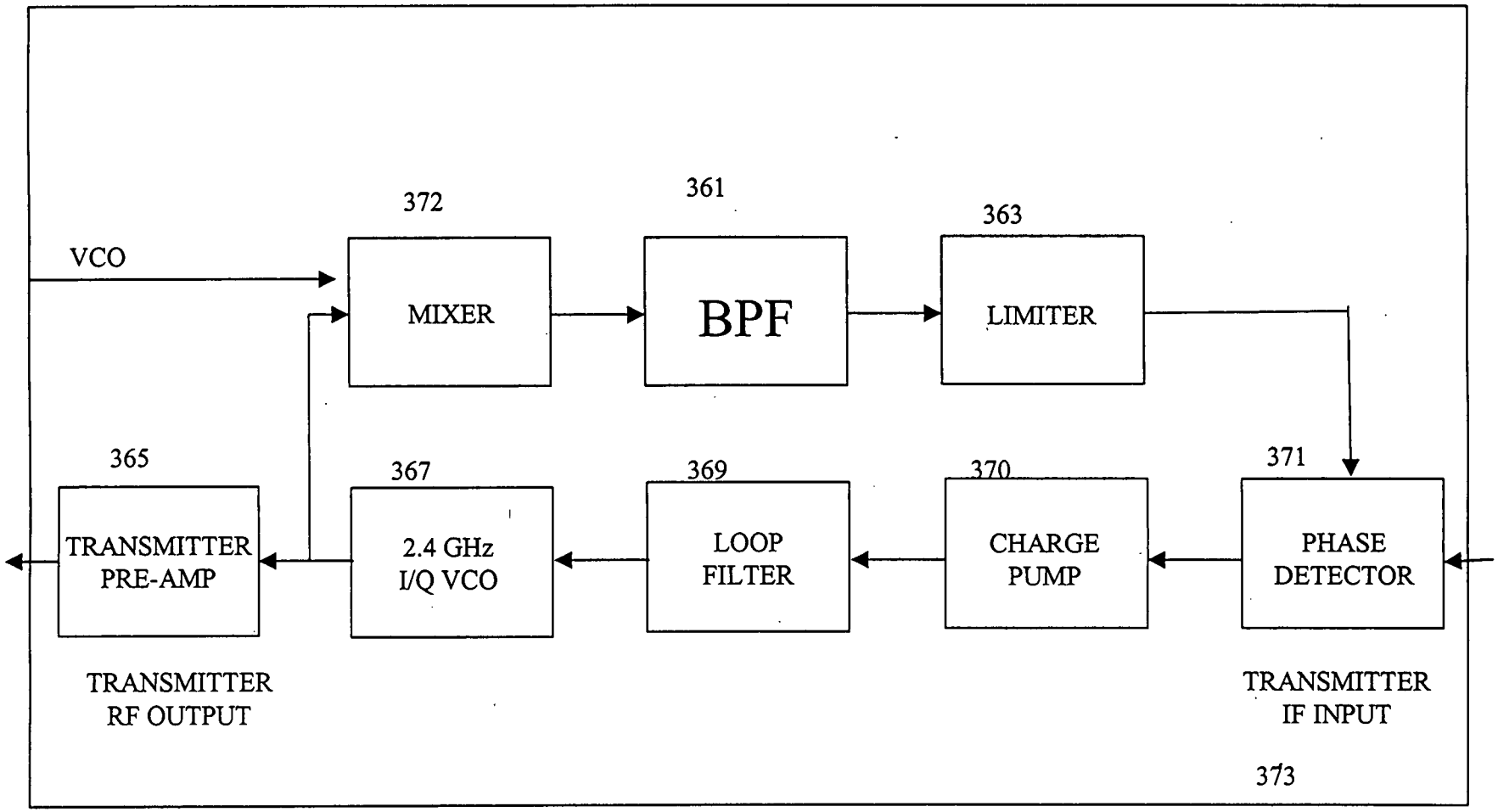

372
361
363
VCO
MIXER
BPF
LIMITER
365
367
369
370
371
TRANSMITTER
PRE-AMP
2.4 GHz
I/Q VCO
LOOP
FILTER
CHARGE
PUMP
PHASE
DETECTOR
TRANSMITTER
RF OUTPUT
TRANSMITTER
IF INPUT
373

FIG. 30c

00201 "26h86960

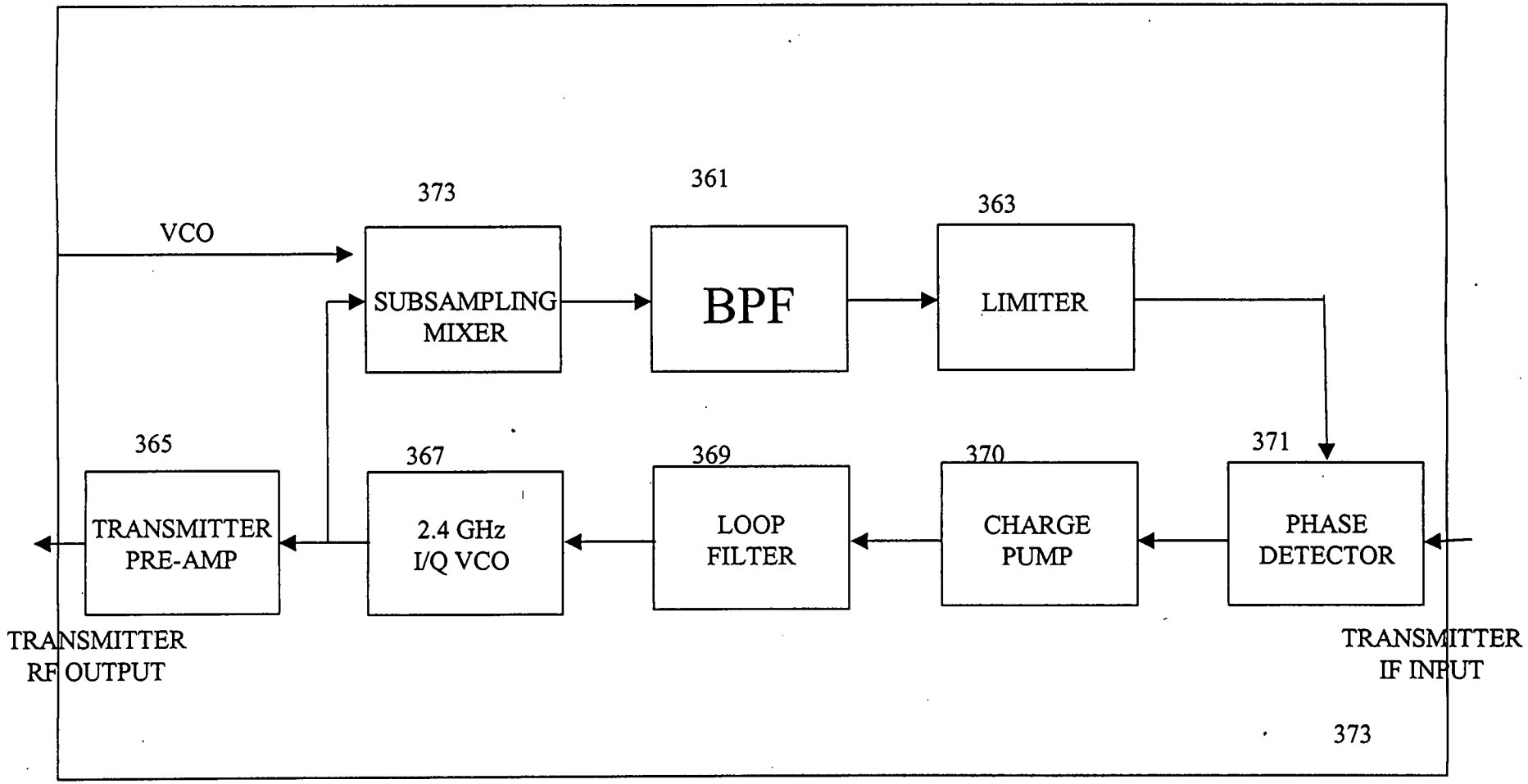


FIG. 30d

.00720T "26h86960

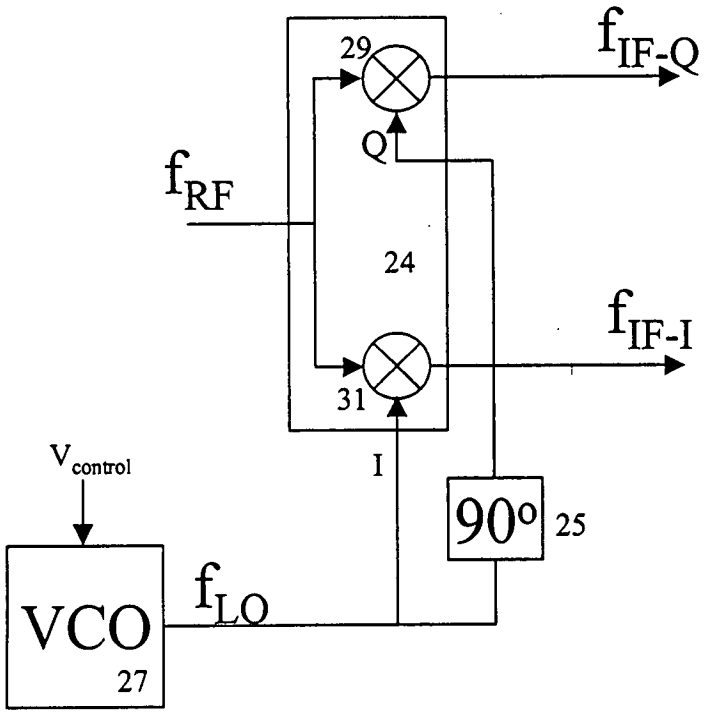


FIG. 30e

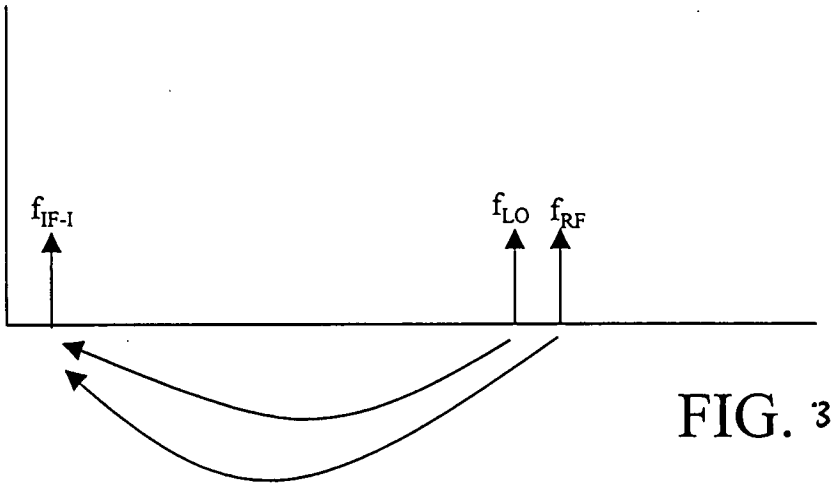


FIG. 30f

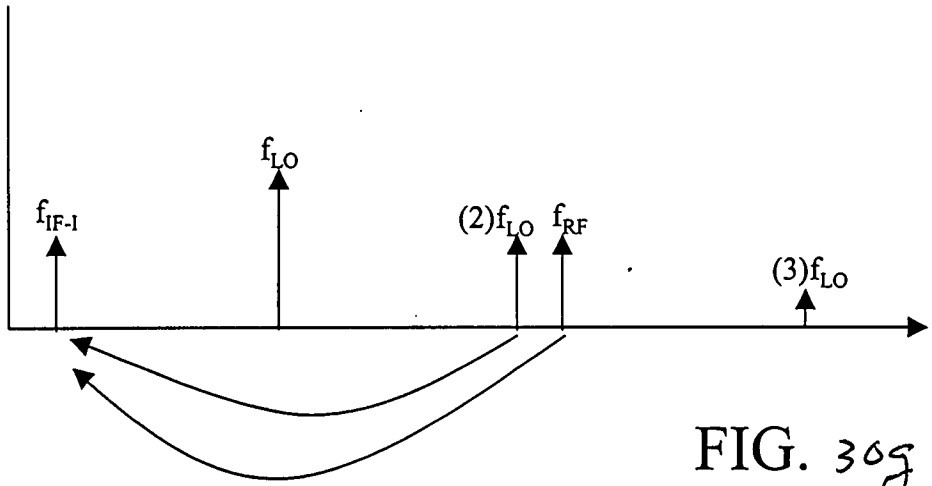
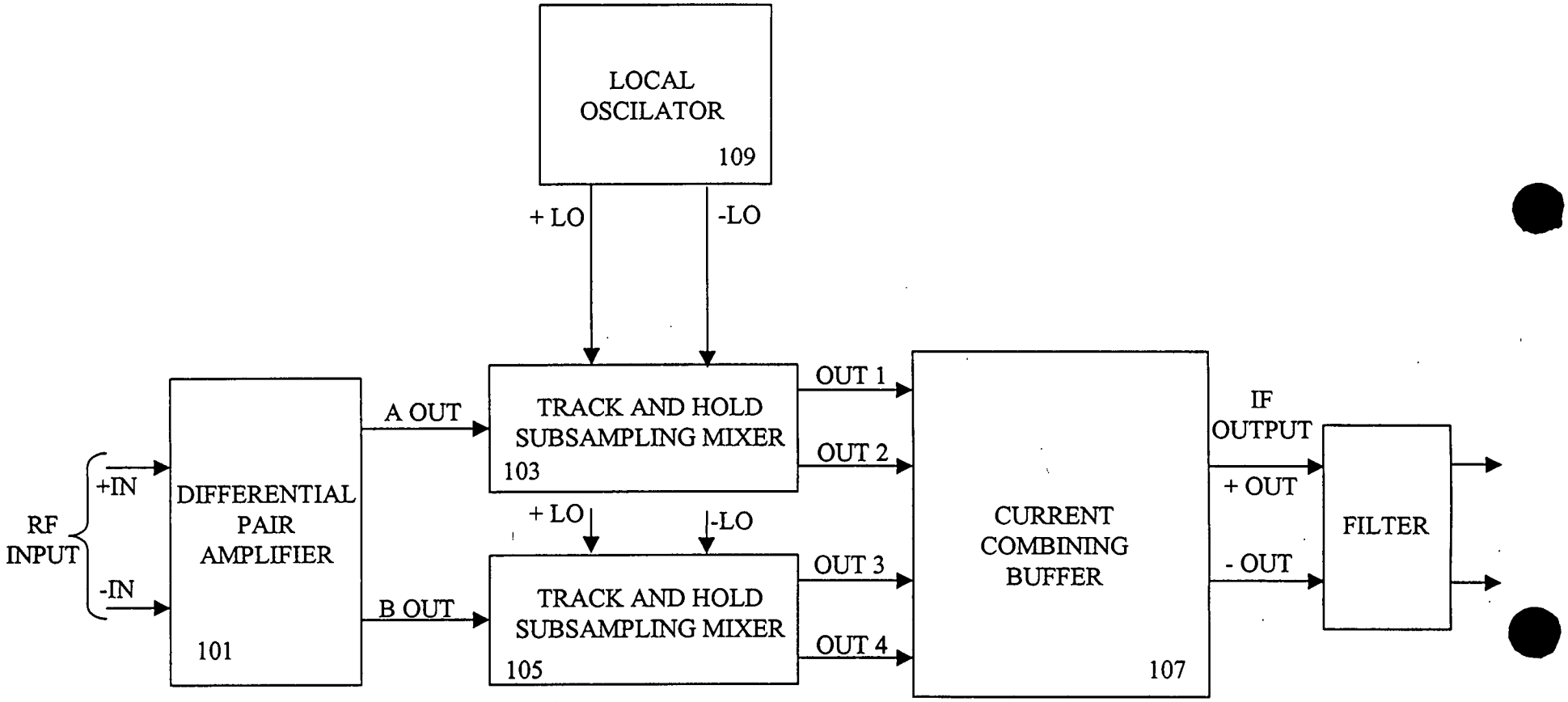


FIG. 30g


LOCAL
OSCILATOR
109
+ LO
-LO
RF
INPUT
+IN
-IN
DIFFERENTIAL
PAIR
AMPLIFIER
101
A OUT
B OUT
TRACK AND HOLD
SUBSAMPLING MIXER
103
+ LO
-LO
TRACK AND HOLD
SUBSAMPLING MIXER
105
OUT 1
OUT 2
OUT 3
OUT 4
CURRENT
COMBINING
BUFFER
107
IF
OUTPUT
+ OUT
- OUT
FILTER

111

FIG. 30h

007207 " 26+86960

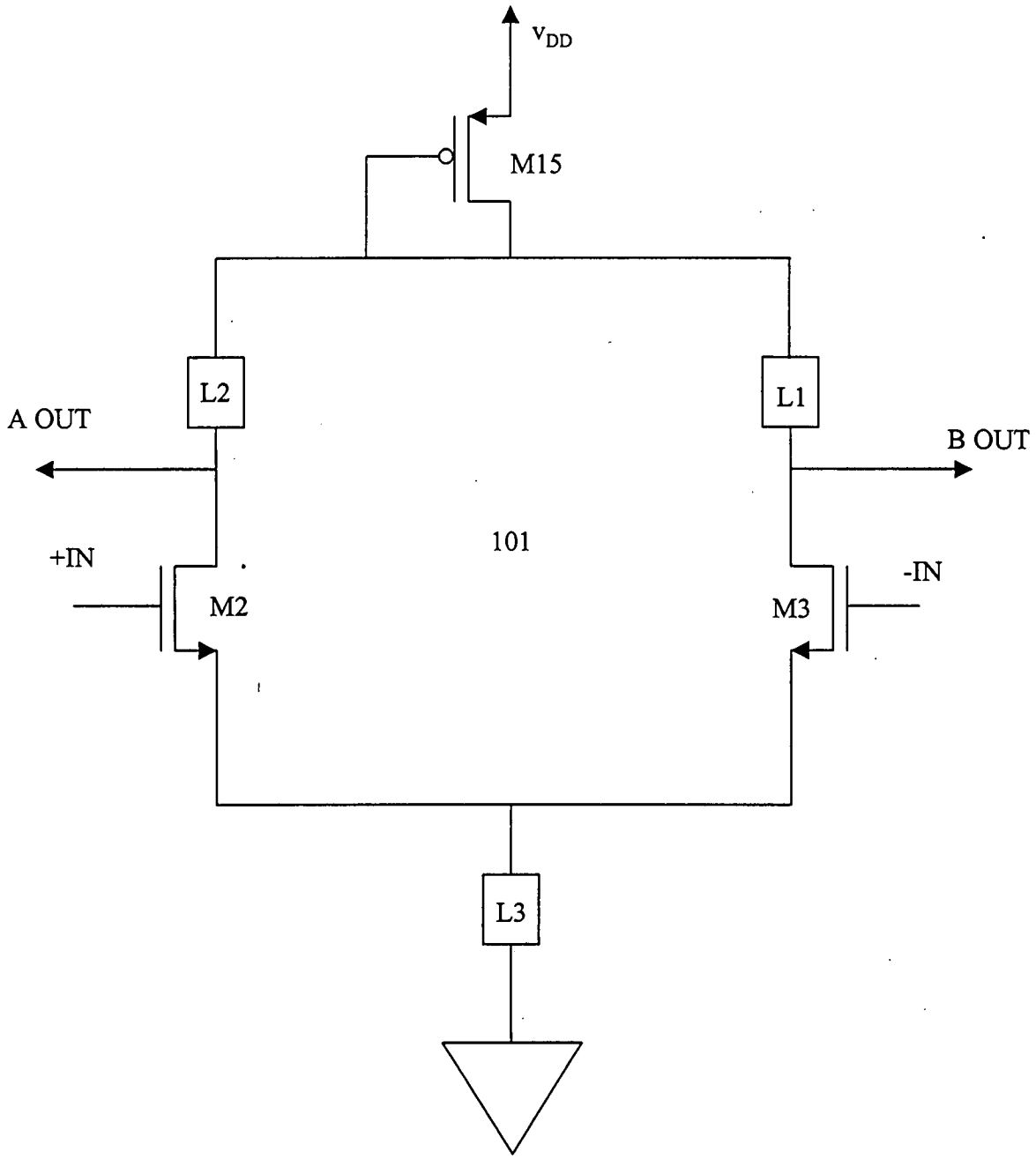


FIG. 30i

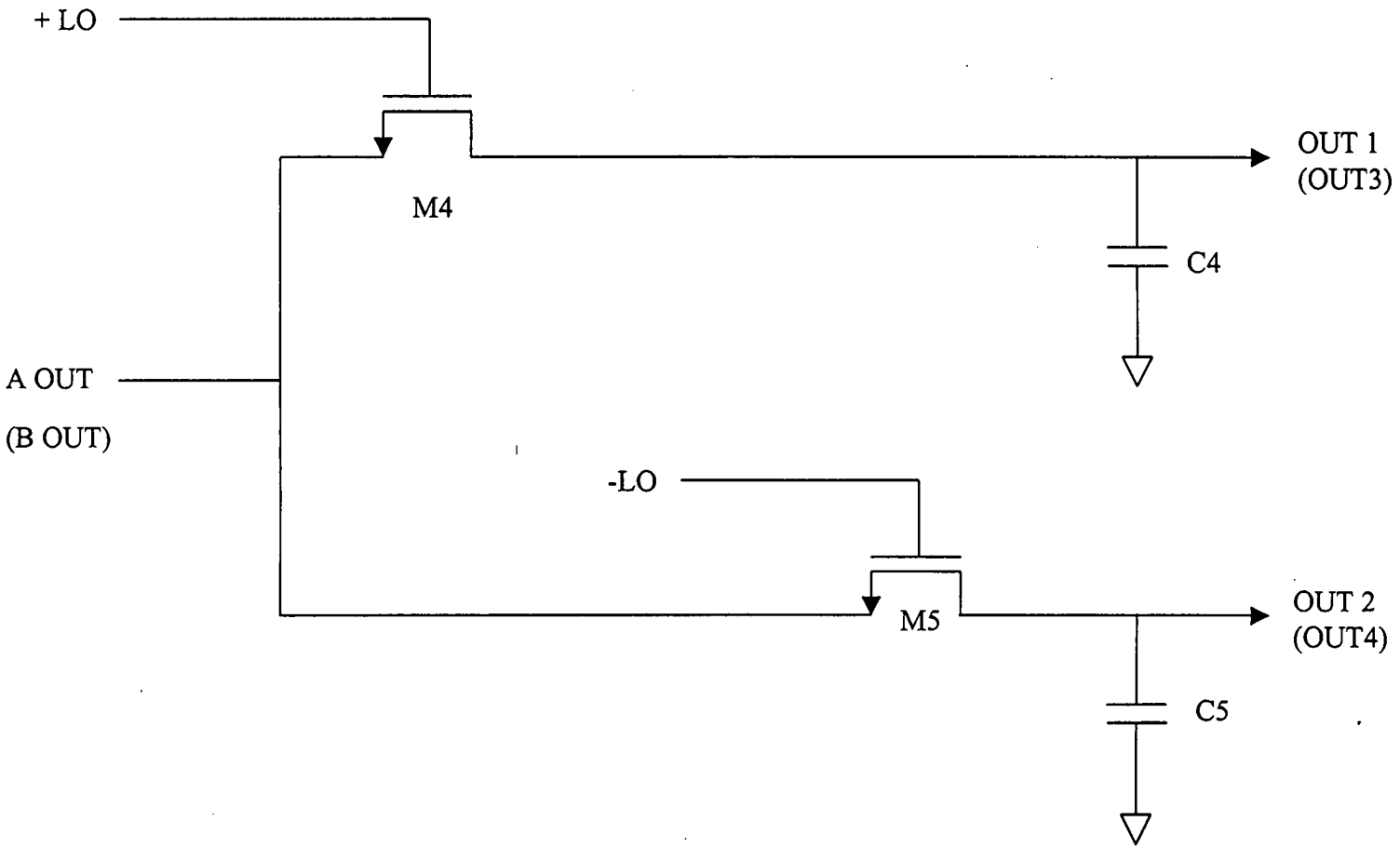


FIG. 30j

00720T "26h86960

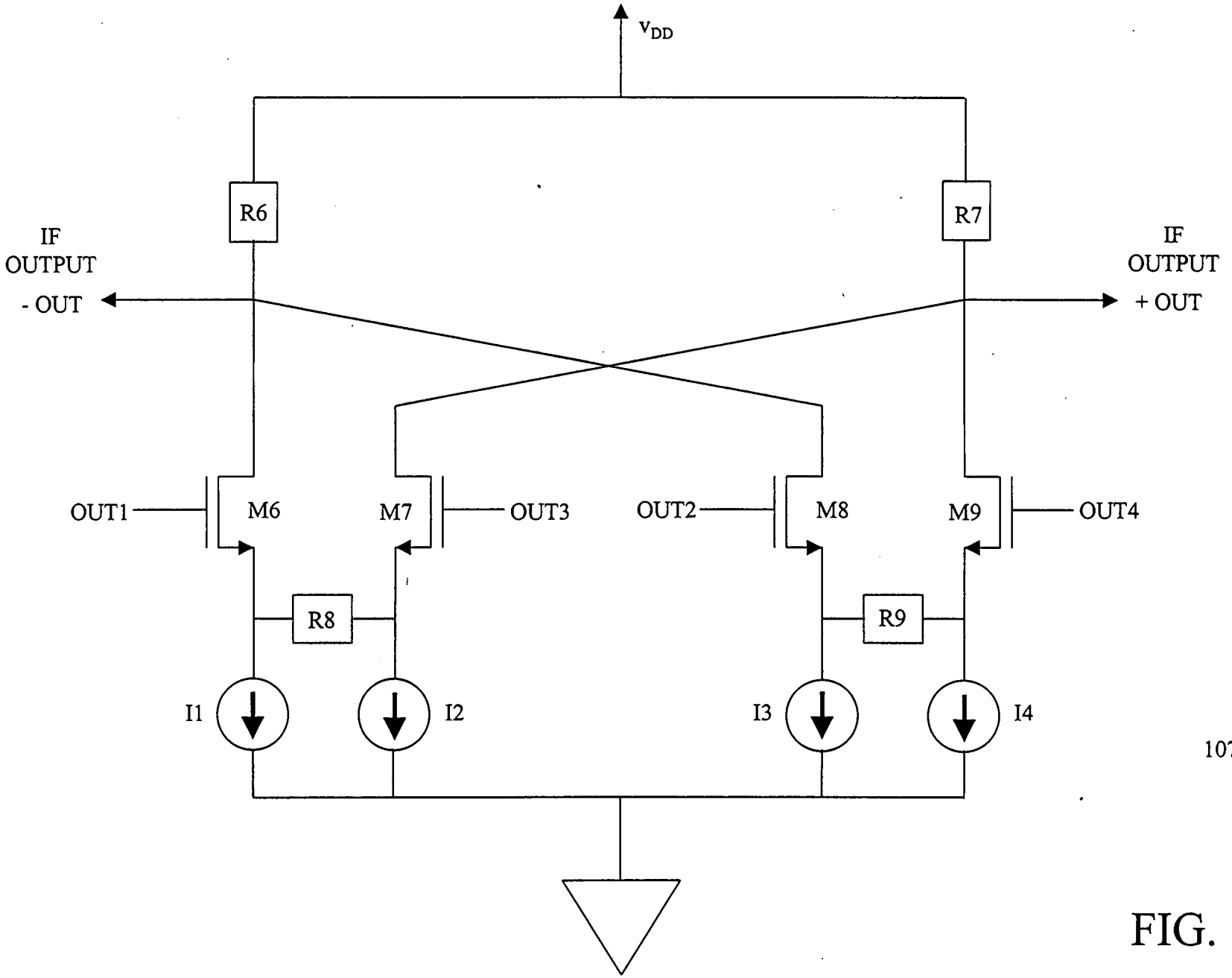
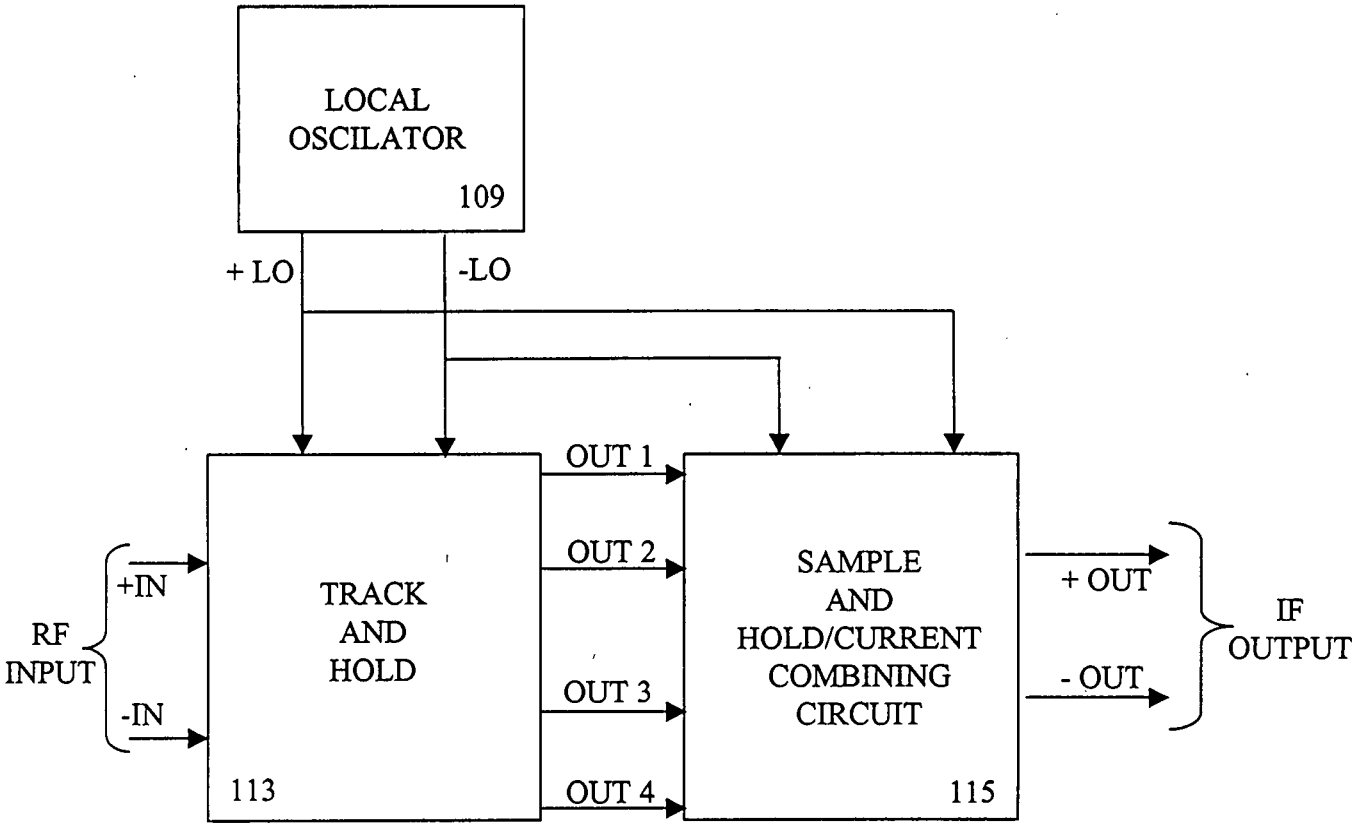
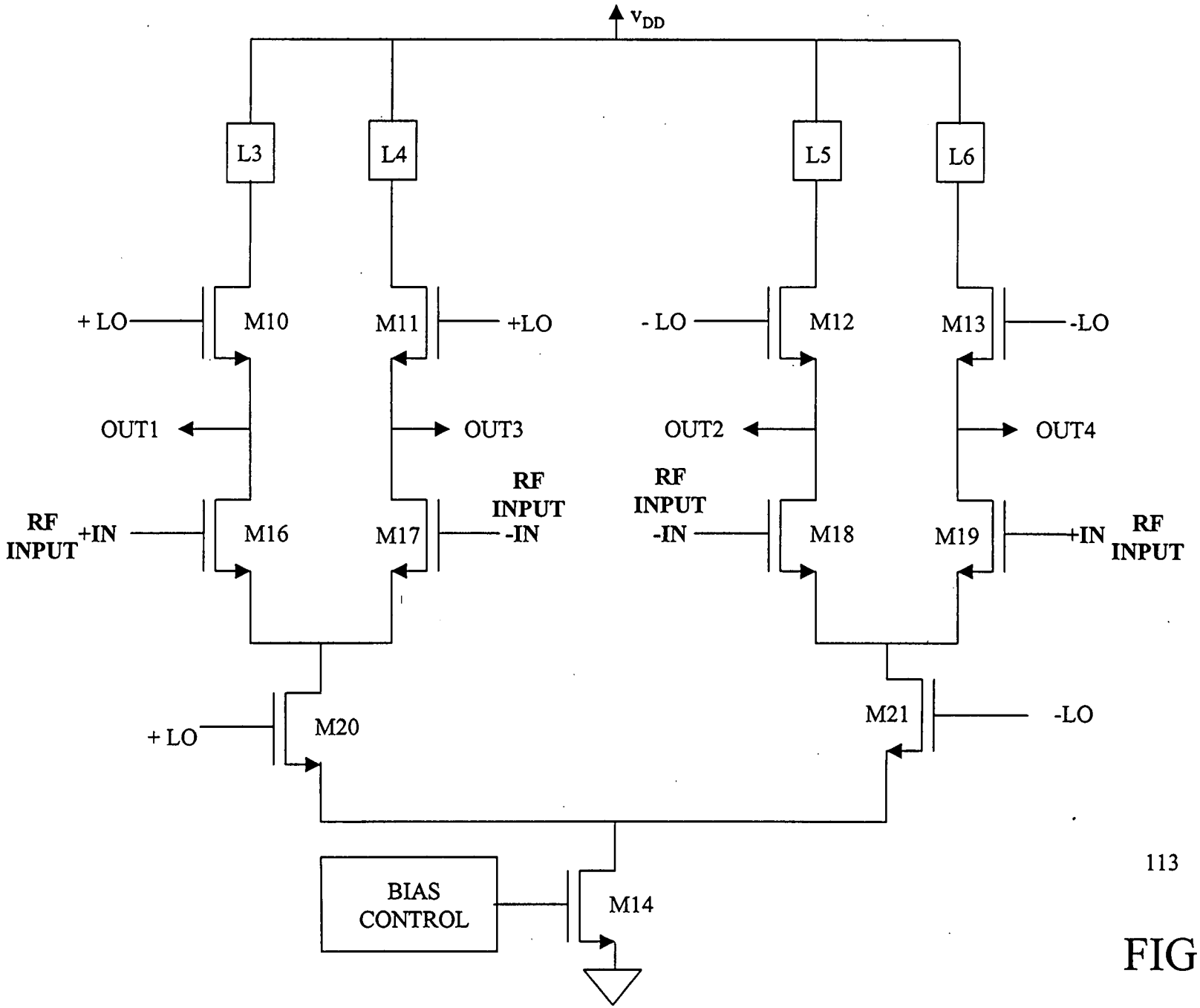


FIG. 30k


LOCAL
OSCILATOR
109
+ LO
-LO
OUT 1
OUT 2
OUT 3
OUT 4
+IN
-IN
RF
INPUT
TRACK
AND
HOLD
113
SAMPLE
AND
HOLD/CURRENT
COMBINING
CIRCUIT
115
+ OUT
- OUT
IF
OUTPUT

111

FIG. 30L


V_{DD}
L3
L4
L5
L6
+ LO
M10
M11
+LO
- LO
M12
M13
-LO
OUT1
OUT3
OUT2
OUT4
RF INPUT +IN
M16
M17
RF INPUT -IN
RF INPUT -IN
M18
M19
+IN RF INPUT
+ LO
M20
M21
-LO
BIAS CONTROL
M14

113

FIG. 30m

00720T" 26h86960

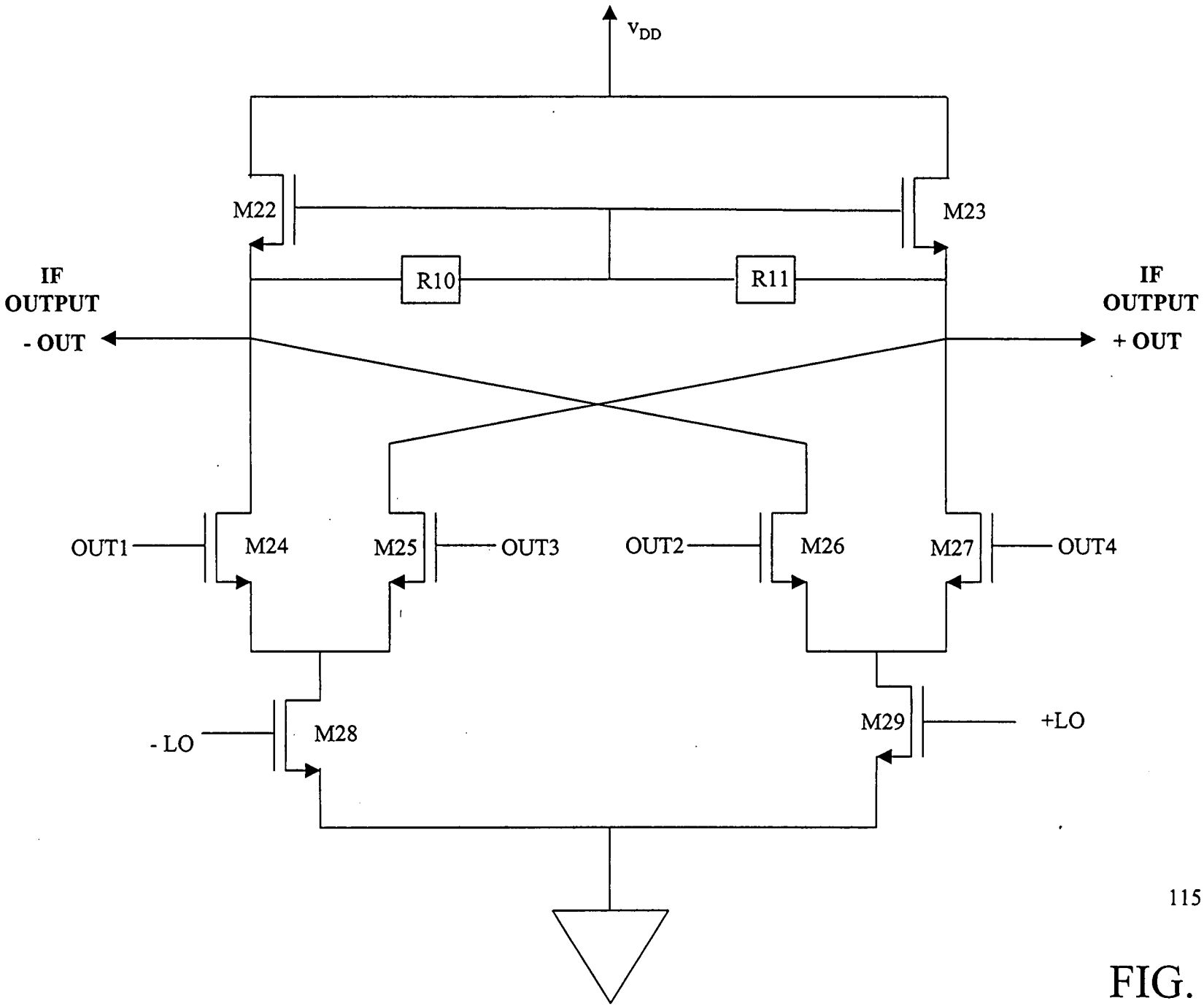


FIG. 30h

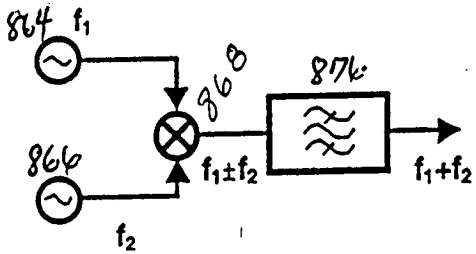


FIG. 31 (a)

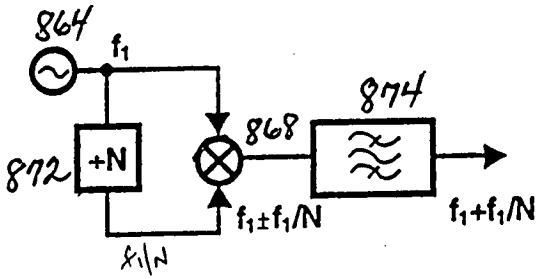


FIG. 31 (b)

0606864v1 - 102700

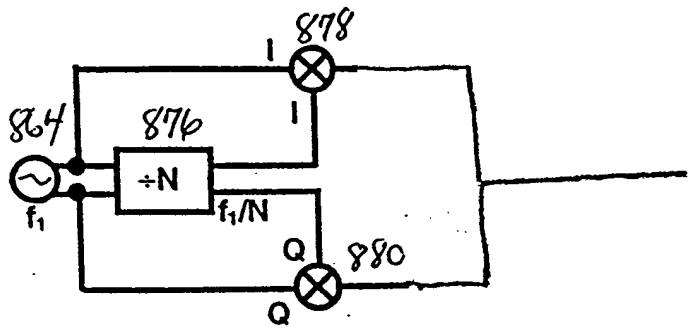


FIG. 32

0072207 - 2548650

FIG. 33(b)

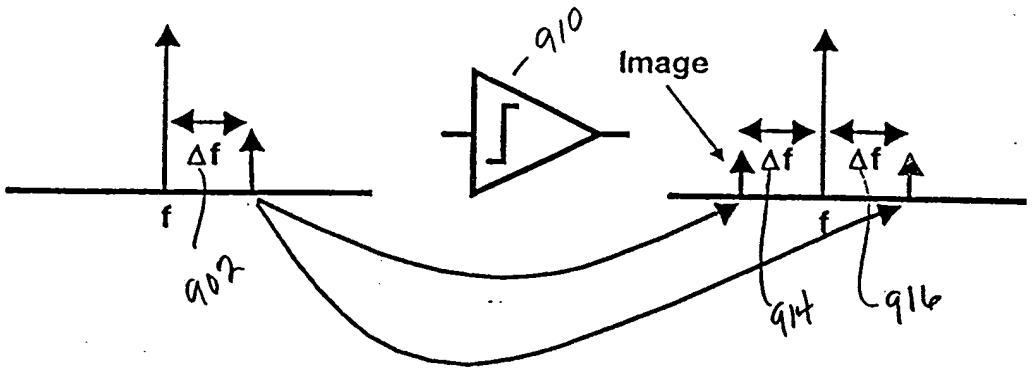


FIG. 33(b)

DocSafe - 4005

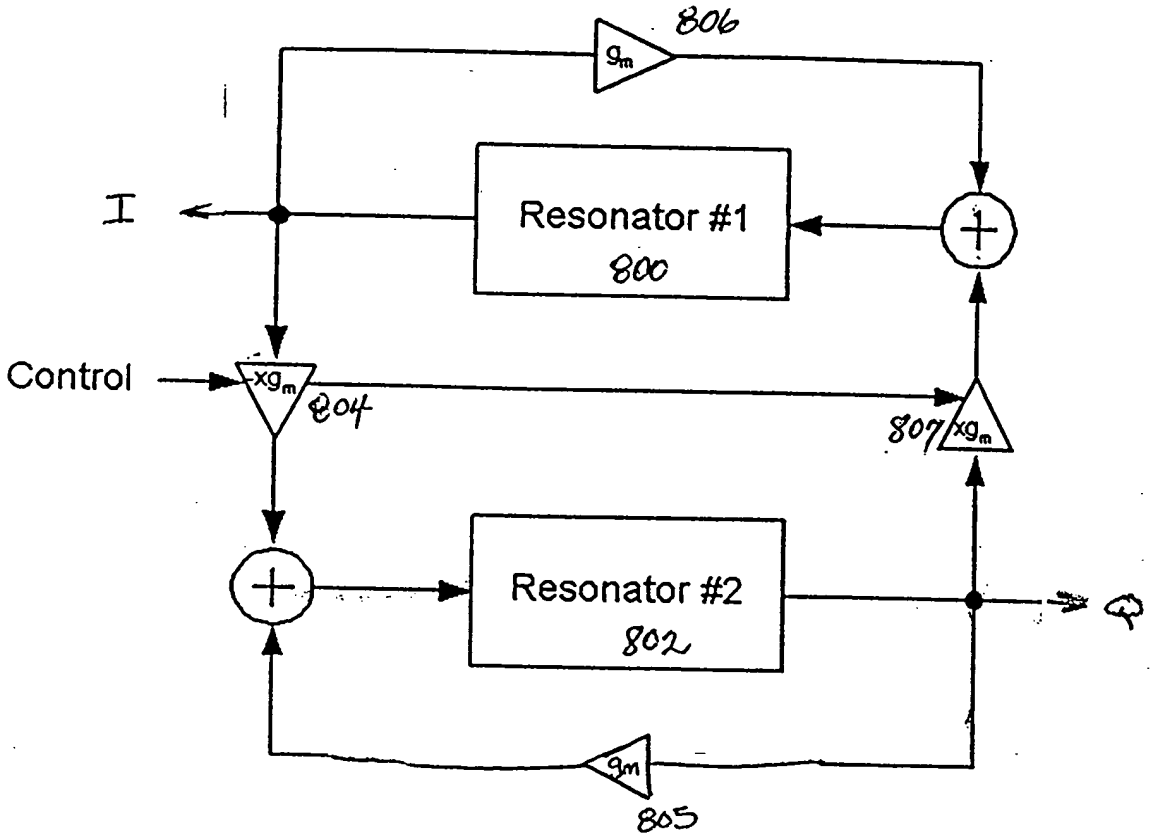

806
g_m
I
Resonator #1
800
Control
xg_m
804
807
xg_m
Resonator #2
802
Q
g_m
805

FIG. 34

0042005.20+88550

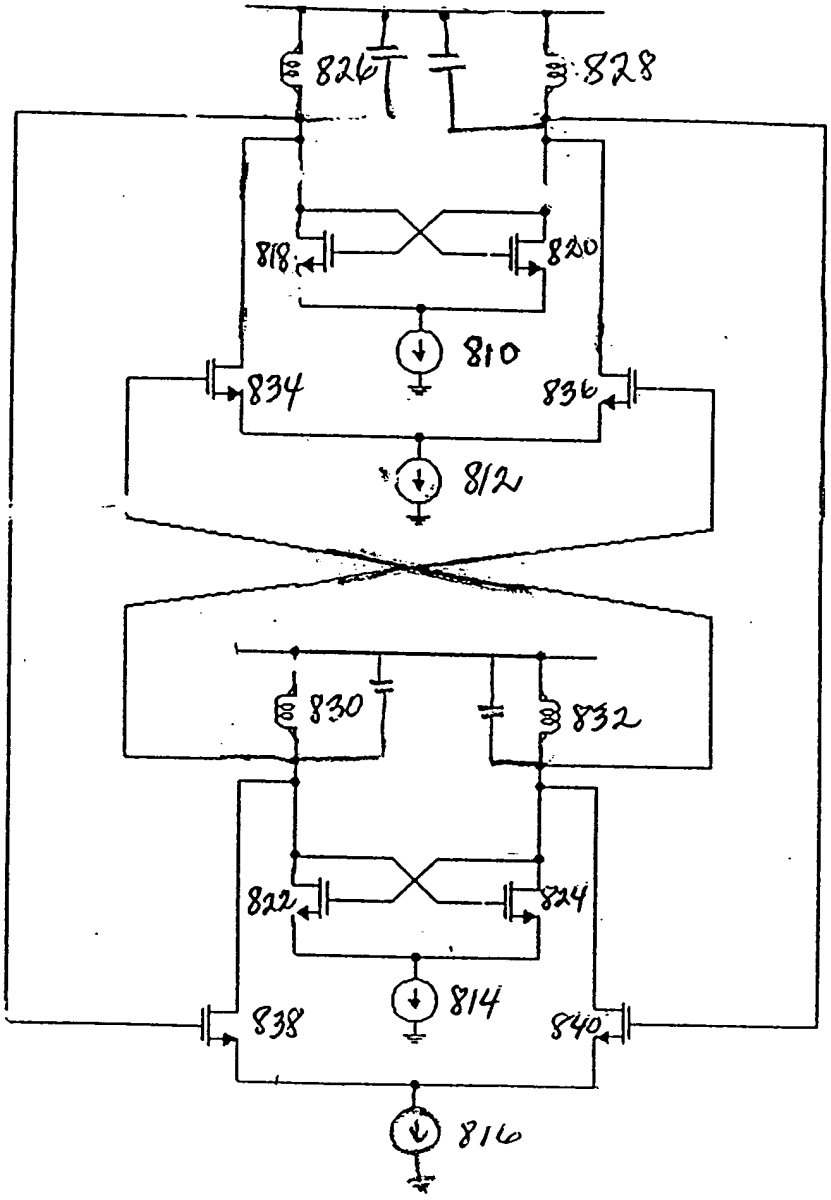
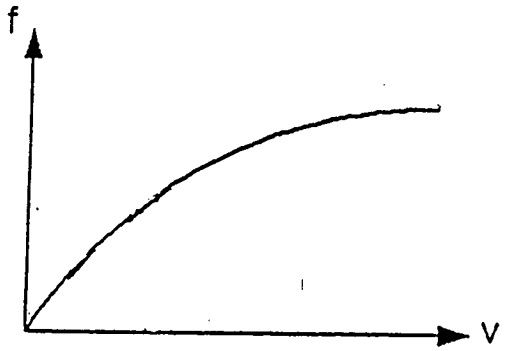
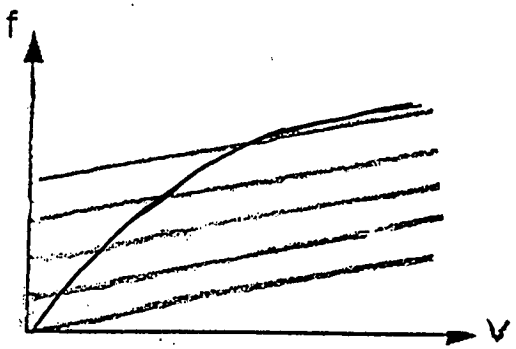


FIG. 35



Typical VCO Tuning Curve

FIG. 36(a)



Segmented VCO Tuning Curve

FIG. 36(b)

FIG. 37(a)

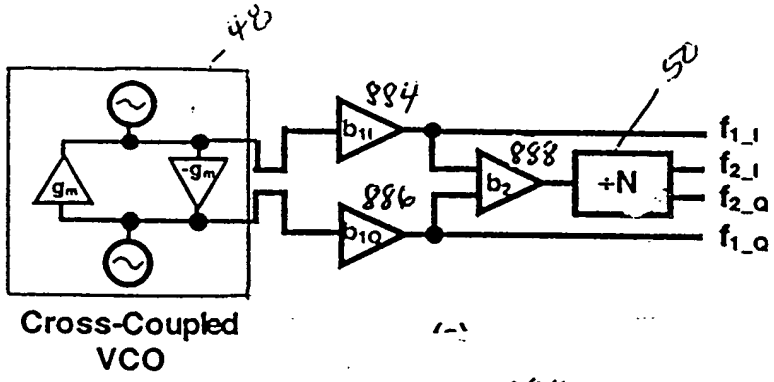
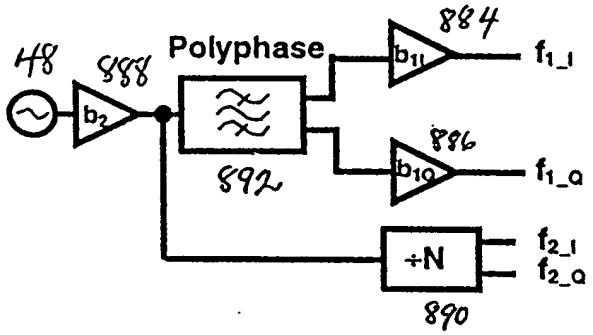


FIG. 37(b)



0000349V.HDV00

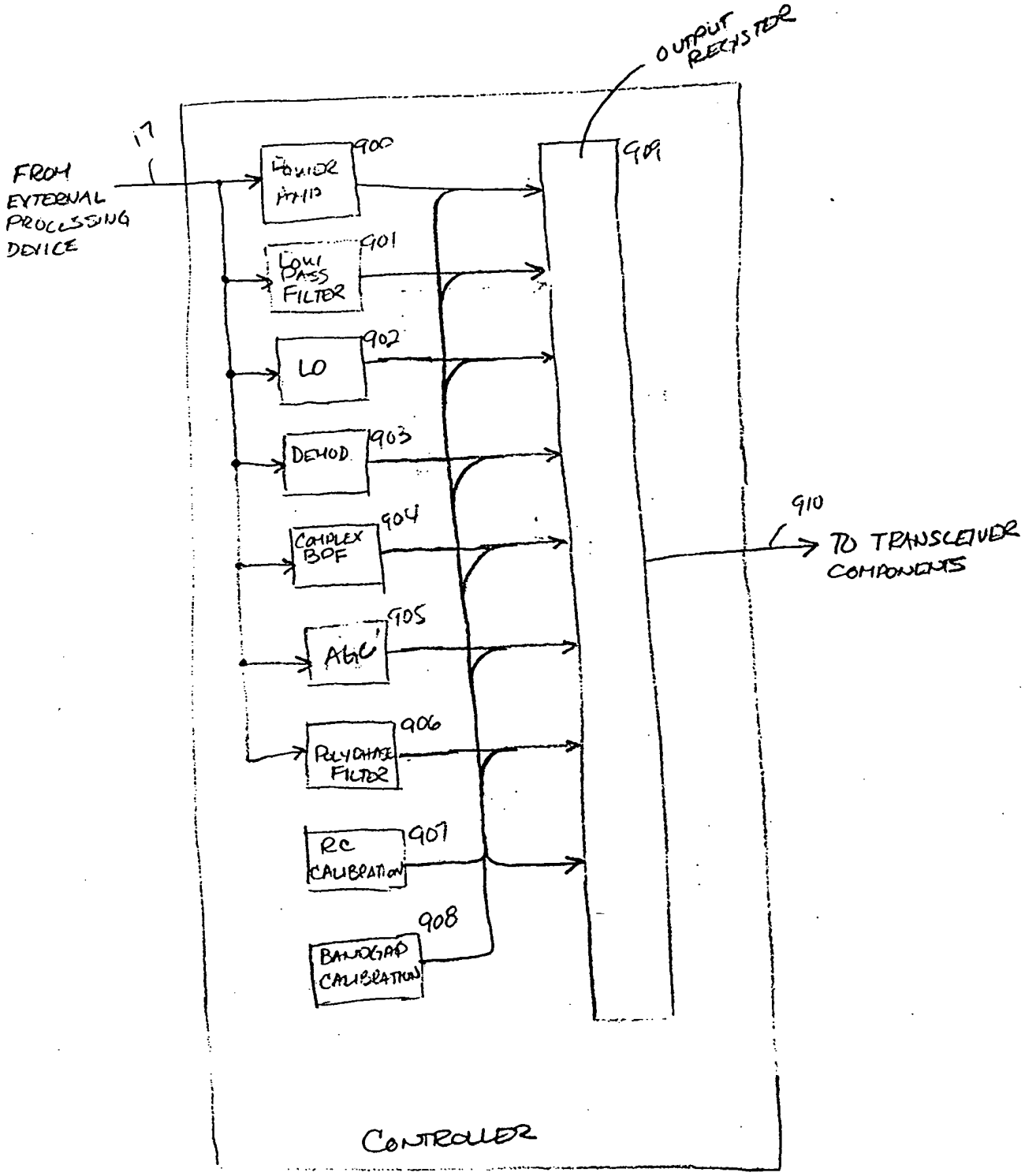


FIGURE 38

0060849 - 4002700

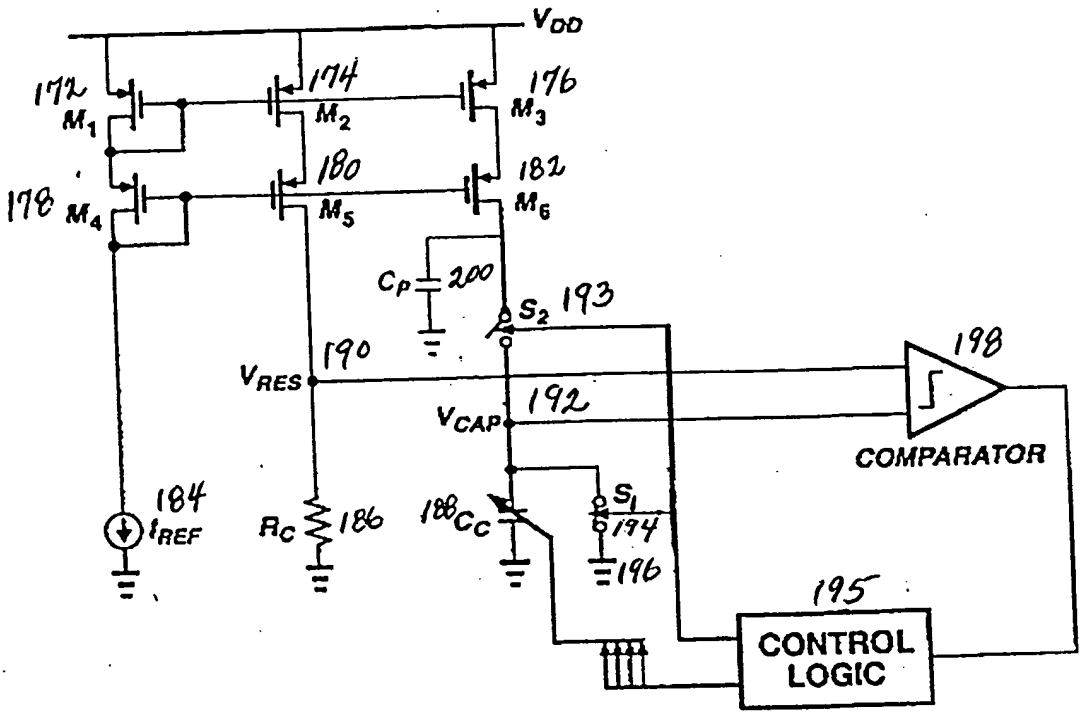

V_{DD}
172
M_1
174
M_2
176
M_3
178
M_4
180
M_5
182
M_6
C_P 200
S_2 193
190
V_{RES}
192
V_{CAP}
198
COMPARATOR
184
I_{REF}
R_C 186
188 C_C
S_1 194
196
195
CONTROL LOGIC

FIG. 39

05668503 - 1020060

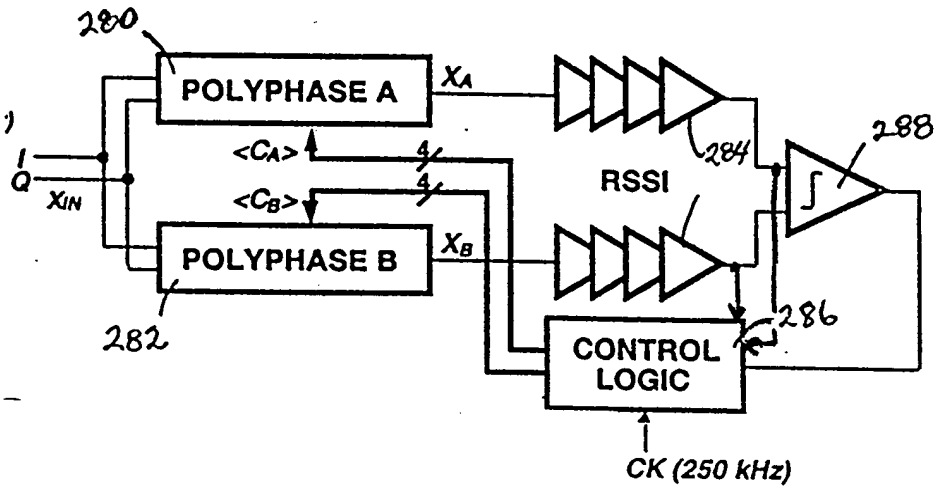


FIG. 40

0050-0050-0050

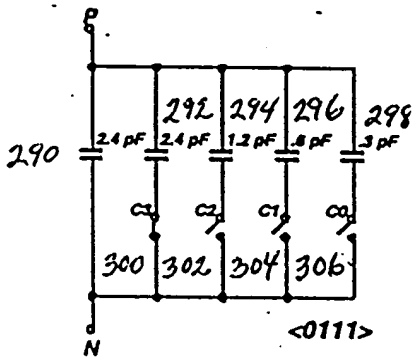


FIG. 41

0005695 - 4050200

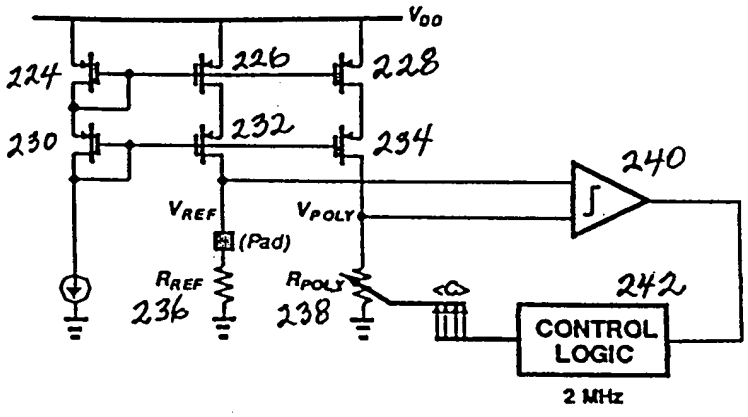


FIG. 42

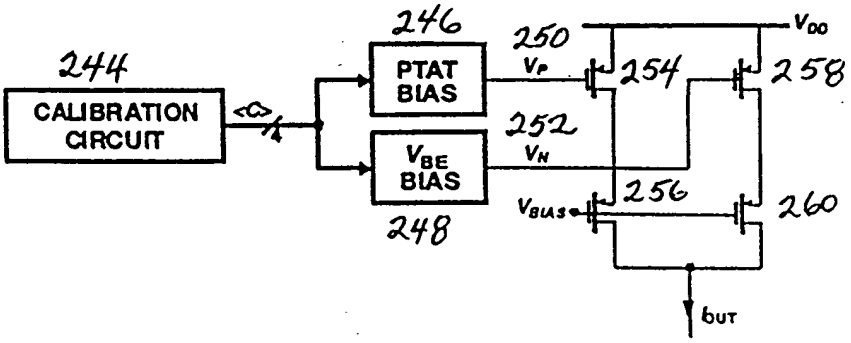


FIG. 43

0605950 - 4052700

US 6,509,604 B2

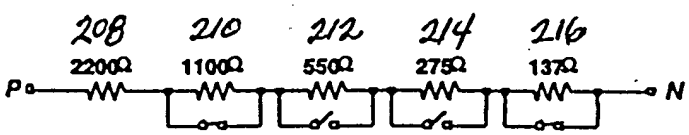


FIG. 44

DOCKET NO. 95-0404

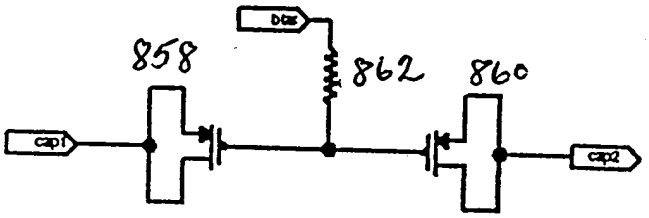


FIG. 45

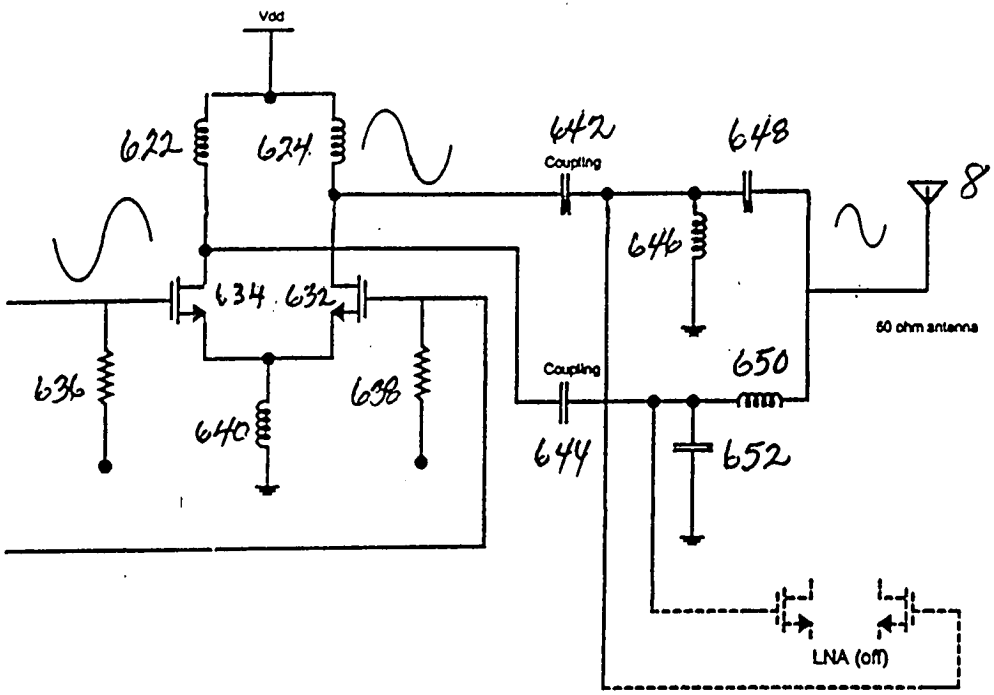

Vdd
622
624
642
Coupling
648
8
646
634
632
636
638
640
Coupling
650
644
652
50 ohm antenna
LNA (off)

FIG. 46

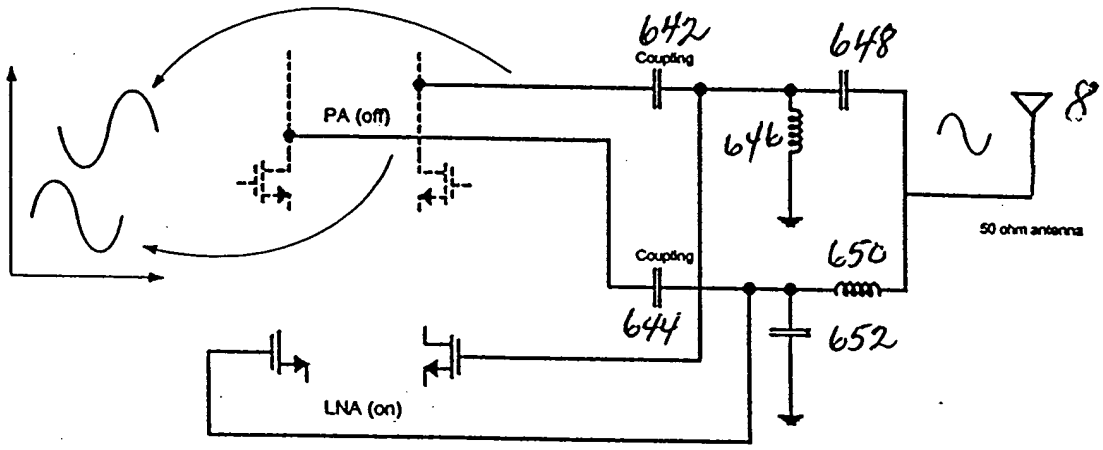


FIG. 47

09609459 - 102700

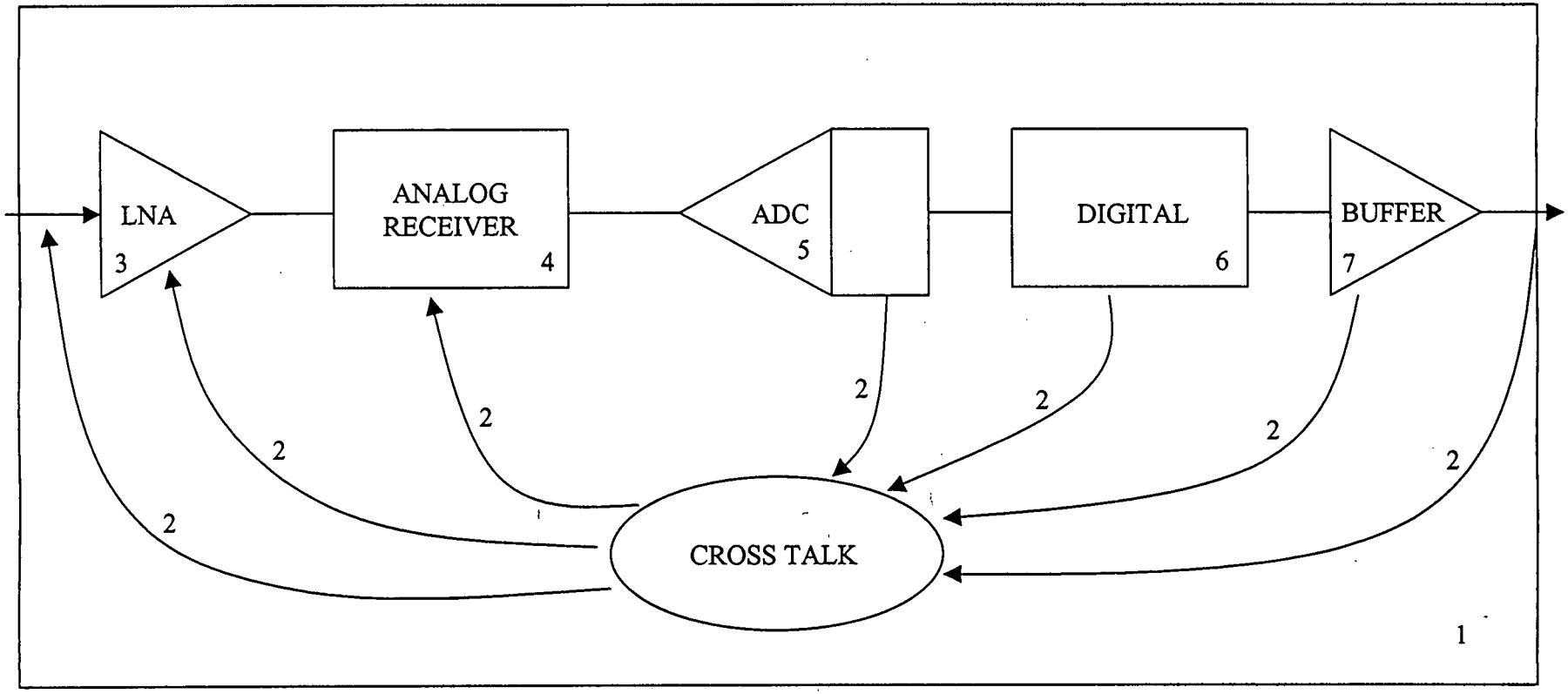

LNA
3
ANALOG
RECEIVER
4
ADC
5
DIGITAL
6
BUFFER
7
2
2
2
2
2
2
2
CROSS TALK
1

FIG. 48a

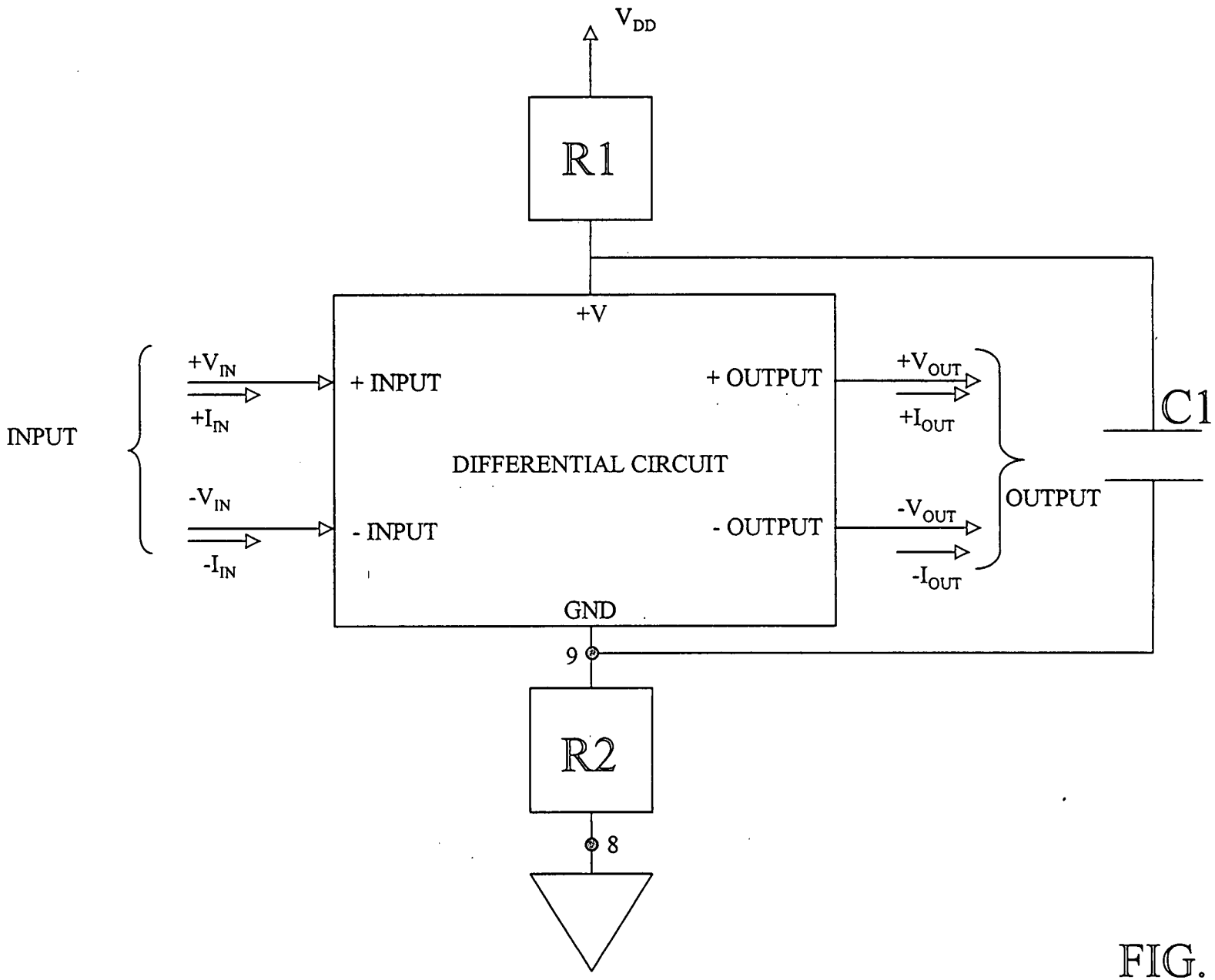

V_{DD}
R1
+V
INPUT
$+V_{IN}$
$+I_{IN}$
$-V_{IN}$
$-I_{IN}$
+ INPUT
- INPUT
DIFFERENTIAL CIRCUIT
+ OUTPUT
- OUTPUT
$+V_{OUT}$
$+I_{OUT}$
$-V_{OUT}$
$-I_{OUT}$
OUTPUT
C1
GND
9
R2
8

FIG. 406

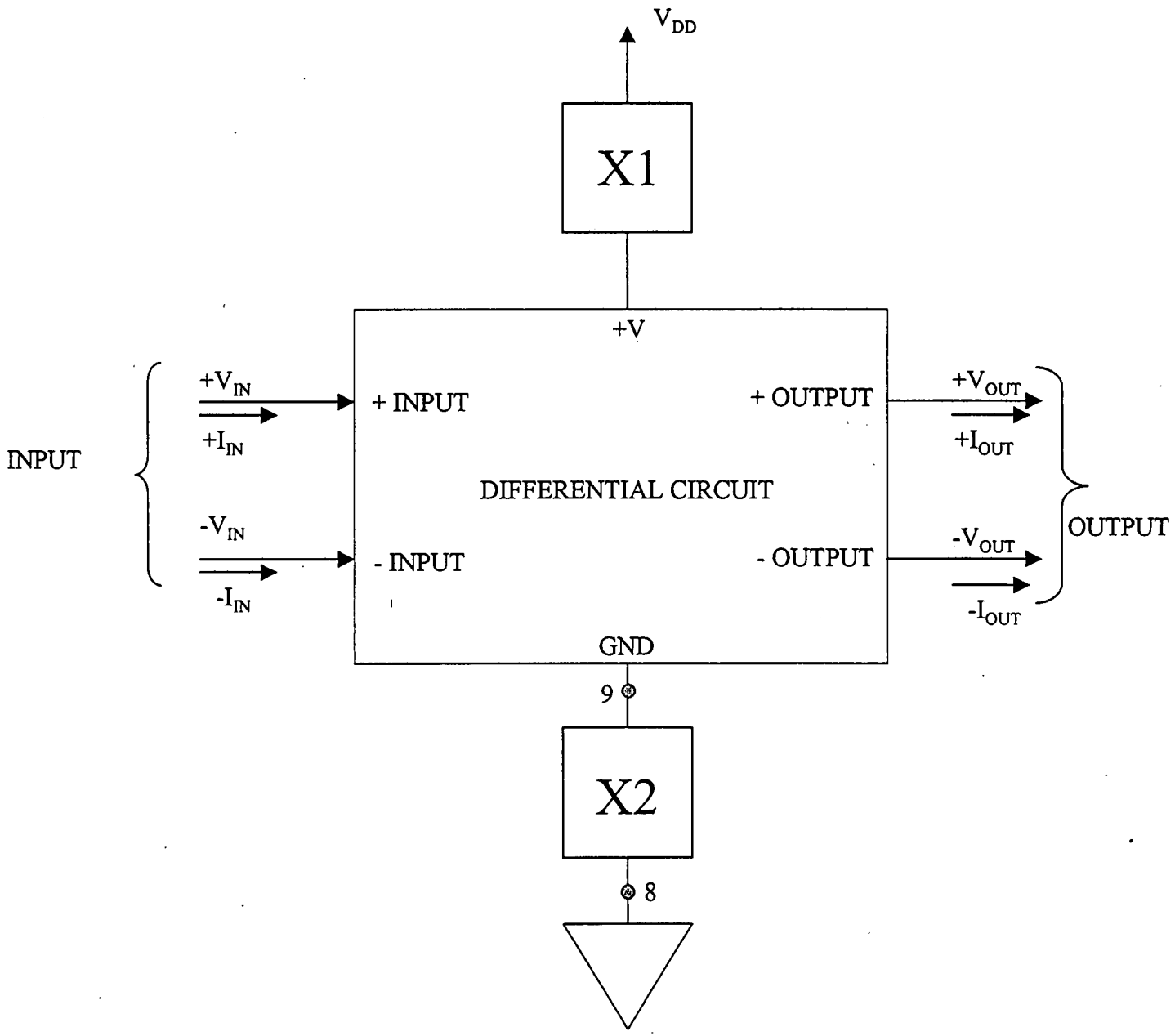

V_{DD}
X1
+V
INPUT
$+V_{IN}$
$+I_{IN}$
+ INPUT
DIFFERENTIAL CIRCUIT
$-V_{IN}$
$-I_{IN}$
- INPUT
+ OUTPUT
$+V_{OUT}$
$+I_{OUT}$
- OUTPUT
$-V_{OUT}$
$-I_{OUT}$
OUTPUT
GND
9
X2
8

FIG. 48c

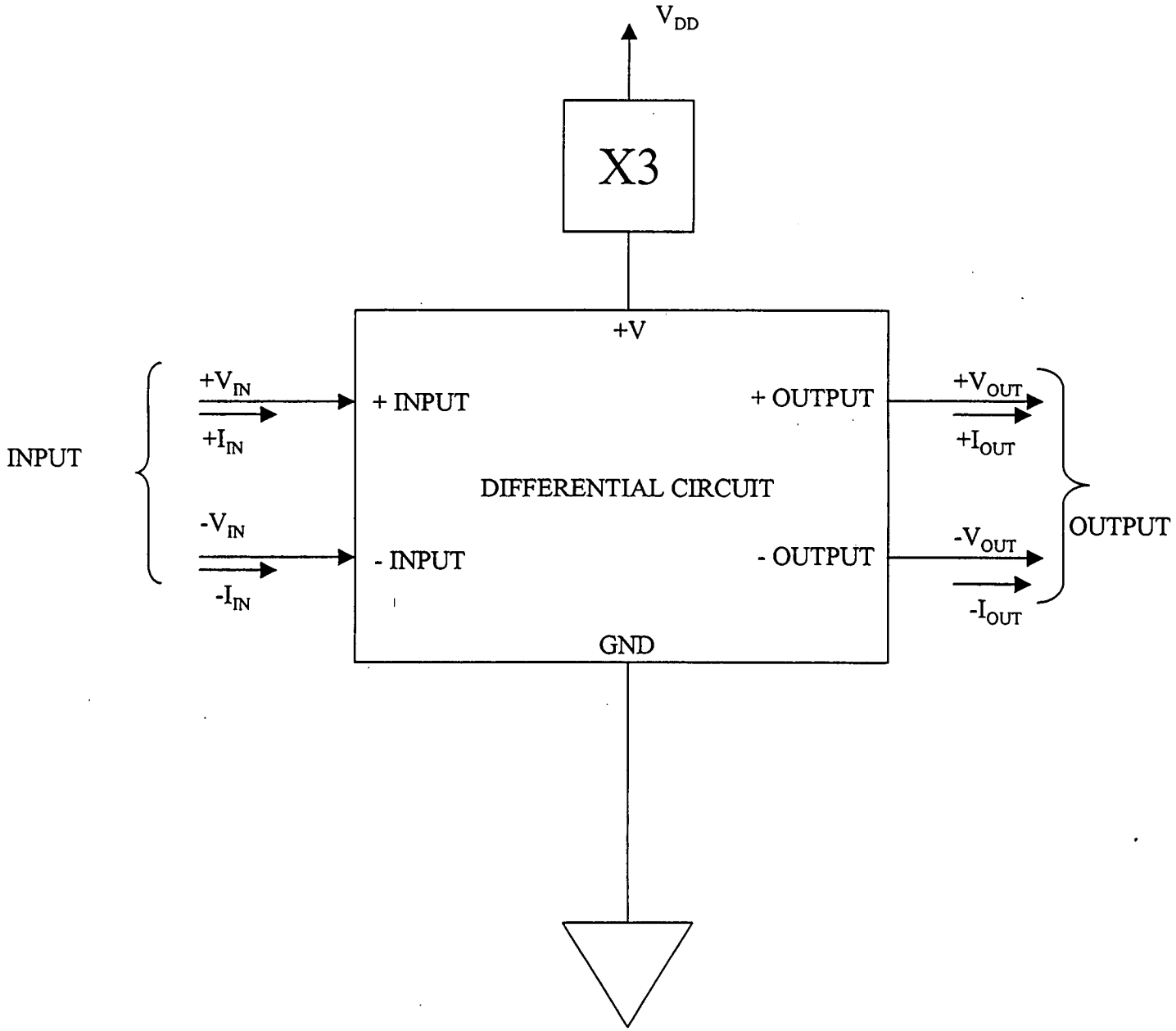

V_{DD}
X3
+V
INPUT
$+V_{IN}$
$+I_{IN}$
$-V_{IN}$
$-I_{IN}$
+ INPUT
- INPUT
DIFFERENTIAL CIRCUIT
+ OUTPUT
- OUTPUT
$+V_{OUT}$
$+I_{OUT}$
$-V_{OUT}$
$-I_{OUT}$
OUTPUT
GND

FIG. 48d

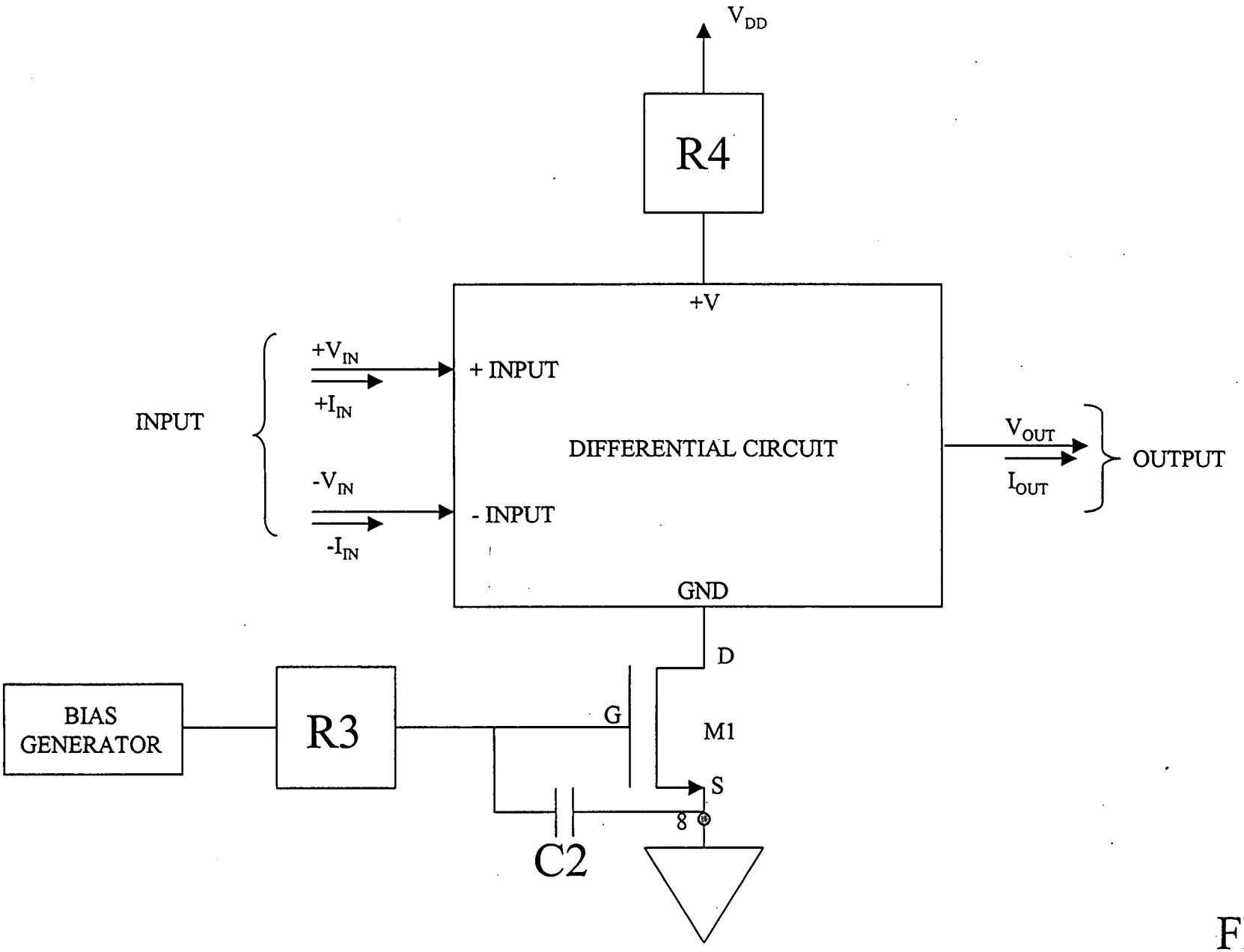

V_{DD}
R4
+V
$+V_{IN}$
$+I_{IN}$
+ INPUT
INPUT
DIFFERENTIAL CIRCUIT
V_{OUT}
I_{OUT}
OUTPUT
$-V_{IN}$
$-I_{IN}$
- INPUT
GND
D
BIAS GENERATOR
R3
G
M1
S
C2

FIG. 48e

00205 "26h8696D

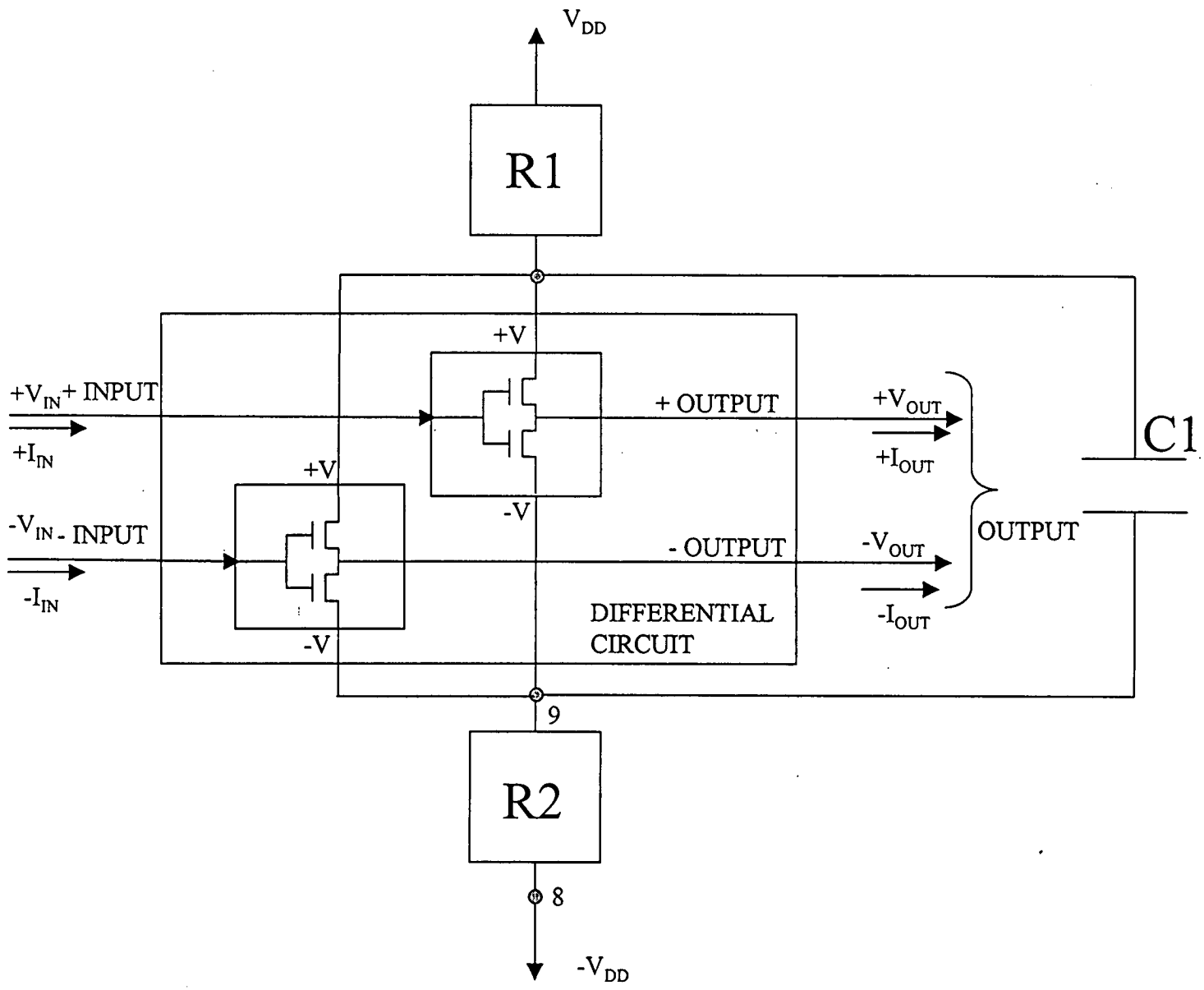


FIG. 48f